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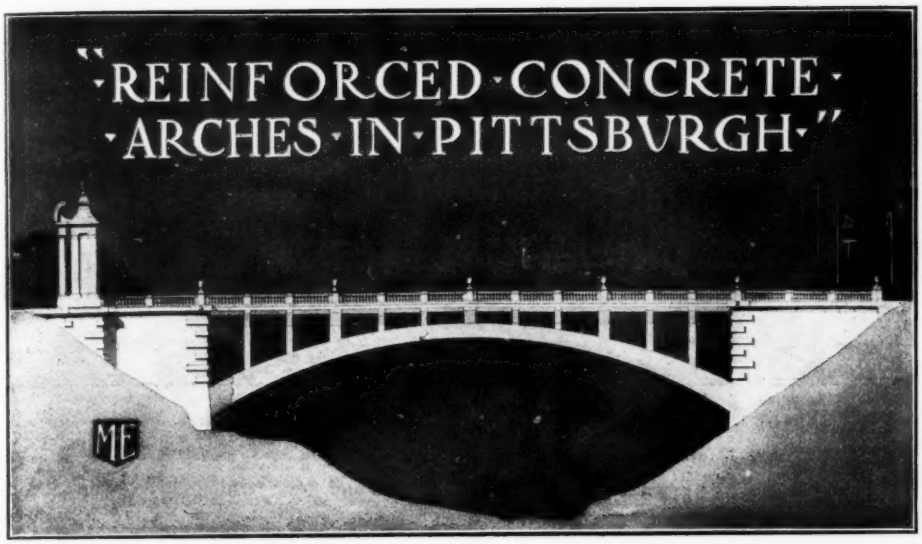
WILLIAM W. MARR

(See Men Prominent in Municipal Affairs, page 204.)

"Reinforced Concrete Arches in Pittsburgh"



WITHIN the last two or three years the city of Pittsburgh, Pa., has distinguished itself by the character and beauty of the designs made for the numerous bridges over streams, railroads, boulevards and streets which are made necessary by the exceedingly irregular topography of the city plans and the necessity of connecting the upper levels of the city without descending to the lower levels. Indeed, as may be seen from the photographs, descent on the one side and ascent on the other would be more difficult and in the long run more expensive than the bridges which are used.

How the Funds Are Raised

The funds required for building the new bridges and rebuilding some of the old ones were raised by votes of the people in 1908 and 1910.

Prior to 1908 the sums paid for bridge maintenance were extremely small, not 1 per cent of the valuation of the property.

There are in the city some 78 bridges of all kinds with spans of 20 to 800 feet, valued at $5,000,000.

Most of the old bridges were of steel, naturally, since Pittsburgh is the center of the steel industry. But, just as naturally, the smoky atmosphere, laden with the gases generated in the manufacture of this steel, attacks the steel and destroys it more rapidly than elsewhere, unless under exceptionally bad conditions.

The Beginning of the Use of Concrete

In 1907 it was decided to use concrete to protect the steel in the bridges and several bridges were encased in concrete in 1908, particularly the columns and struts. Among the bridges so treated were Millvale avenue and Twenty-eighth street bridges over the Pennsylvania railroad. Cement sidewalks, acting in part as protection to the steel, were laid on South Tenth and Twenty-second streets, Negley and Aiken avenue and several smaller bridges.

In 1909 three small wooden bridges over Saw Mill Run were replaced with reinforced concrete girders of 15.5 to 35 feet span and 12 to 20-foot roadways, supported on masonry abutments. Graham and Blaine street foot bridges over railroad tracks were also constructed of reinforced concrete.

The popular votes were for bond issues to pay for projects which included several large bridges and it was decided to build six of these of reinforced concrete. Their size and prominence really demanded artistic treatment and the designs show that graceful lines and pleas-

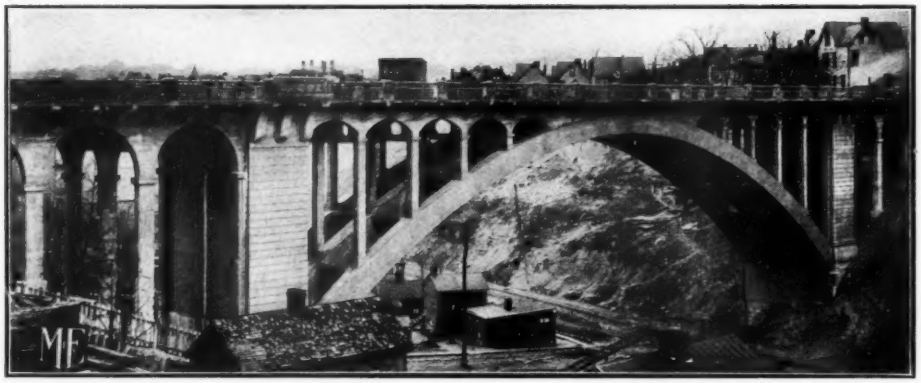


PLATE I. *Meadow Street Bridge over Negley Run, Looking North.*

ing composition have been duly considered.

Meadow Street Bridge

The first of these bridges was the Meadow street bridge over Negley Run, shown in Plate I. This span is 209 feet long, with rise of 46.14 feet, a proportion of 1 to 4.53. The total length of the bridge is 454 feet and its width is 50 feet; there being two 10-foot sidewalks, which overhang the outside ribs of the arches and are supported on cantilever brackets.

The main span is a three-centered arch approaching a parabola, with the line of pressure close to the axis of the arch ribs at all points.

There are three of these arch ribs, having depth of 5 feet at the crown and 6 feet 2 inches at the springing line. The two outside ribs are 3 feet 9 inches wide throughout and the center rib 5 feet. These ribs are bound together by the horizontal struts seen in the photograph, causing them to act together against all lateral stresses.

The main piers are of cellular construction. The secondary arch system with its column supports and lateral bracing as their tops is clearly shown in the photograph.

The reinforcement is of monolith bars, made of medium open-hearth steel.

The bridge cost $72,000.

Atherton Avenue Bridge

Atherton avenue is one block from Center avenue and parallel with it. To relieve the congestion on the latter street the former was widened and improved. This required two new bridges. One of these, over the Pittsburgh Junction railroad is shown in Plate II. Contract and specifications for this bridge were prepared in 1911 and it is now finished at a cost of $95,000.

The main span is 168.5 feet, with a rise of 32.5 feet. The total length of the bridge is 418 feet, and its width is 60 feet with two 12-foot sidewalks, which are flush with the outer faces of the arch ribs. The main span has two arch ribs set 37.5 feet apart between centers and each one 14 feet wide, 3.5 feet deep at the crown and 7 feet deep at the springing line. The span on the left in the photograph is 60 feet and that on the right (east) is 45 feet with the same two arch ribs of the same width.

The piers are solid, to take the thrust of the short arches, which, as shown, spring from the abutments a considerable distance, 22.8 feet, above the springing line of the main arch.

Structural steel was used as reinforcement in the main arch ribs, and Kahn and Diamond bars were used elsewhere. All steel is open hearth. The concrete in arch ribs was of broken stone aggregate in 1:2:4 proportions; that in the foundations was of 1:2:5:5 proportions and in columns, floor system and all other parts of 1:2:4 proportions with gravel aggregate. The bridge contains 7,960 cubic yards of concrete and 626,800 pounds of steel reinforcement.

The valley which this bridge crosses is of less depth and width than that crossed by the Meadow street bridge and the proportion of rise to span is less, being about 1:5. This makes a material difference in the character of the designs and in the appearance of the bridges.

Another Atherton Avenue Bridge

Plate III shows another bridge on the widened and improved Atherton avenue, which crosses the Pennsylvania railroad. This bridge was begun and finished in 1912, except railing and pavement. The valley which it crosses is wide and comparatively shallow and the street crosses the railroad at an angle of 62 degrees 45 minutes, so that skew arches are required. There are three 90-foot arches, the total length of the bridge and approaches is 380 feet, the width 60 feet with two 12-foot sidewalks, flush with the arch faces. The arch rings are 2.5 feet deep at the crown and 9 feet vertical depth at the springing line.

Steel centering was used for the construction of the arches and spans the tracks under the arch as shown in Plate III. One-half of the arch rings for the width of the bridge were first constructed for the full length of the three spans. The false work was then lowered onto rollers and shifted into position for building the other half of the arch rings.

A gravity system, as shown in the photograph, was used in placing the concrete, the restricted spaces at the ends of the bridge preventing the use of cableways as in the other bridges mentioned.

The bridge is complete as shown, except railing and pavement. There are 8,700 cubic yards of concrete and 519,000 pounds of steel reinforcement in its and the total cost will be about $95,000. Diamon bars were used and in the arch rings they were held in place by structural steel cross struts, to which they were attached.

Surface Finish of Concrete

Two kinds of surface finish can be distinguished in some of the photographs. For the plain finish the forms were removed in 24 to 48 hours after the concrete was placed and the surfaces were immediately rubbed with suitable appliances to remove all form marks and other surface irregularities so as to leave them all plane and true and of a uniform sandy finish over the whole surface so worked. On most bridges a smooth coat of Portland cement grout, 1 cement to 2 sand, was applied with a brush, but that was omitted in this case. For the ornamental surfaces the specifications required in this bridge that not less than 30 days after placing the concrete the surface should be gone over with a bush hammer having not more than eight points per square inch of the hammer surface. The concrete was carefully spaded while it was being placed so as to remove the larger stones from the surface.

The ornamental surfaces on the bridge, shown in Plate II, were made by placing a mortar coating 1½ inches thick next the forms, which was thoroughly bonded to the concrete by tamping as it was placed. The bush hammer, if pneumatic, was required to have not more than one point per square inch of hammer face, or not more than four if a hand tool.

The intrados of the arch spans was rubbed off to a smooth, even surface, free

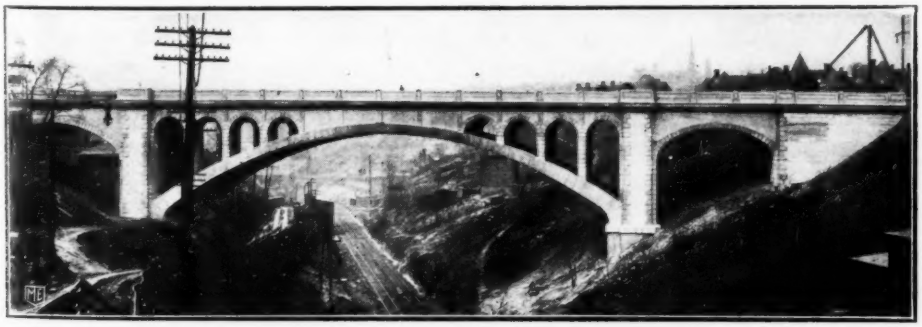


PLATE II. *Atherton Avenue Bridge over Pittsburg Junction Railroad, Looking North.*

from all fins, rough spots or blemishes.

The filling for roadway and sidewalks is blast furnace slag, granulated, and retained by spandrel walls. The sidewalks and the concrete base of the asphalt pavement will be laid on this slag filling.

Waterproofing

The extrados of the arch spans were waterproofed by rubbing off all rough places, scum or laitance so as to leave a uniform, sandy surface, smooth and true to curvature, which was given three finish coats of a mixture of two parts Portland cement and one part sharp sand passing a 12-mesh screen. Each coat was thoroly brushed into the entire surface so as to form a uniform unbroken crating which was allowed to set hard before applying the next. The first coat was rubbed in thoroly with a wooden float and the last coat was smoothed down with a trowel.

Larimer Avenue Bridge

The Larimer avenue bridge over Washington boulevard, finished in the summer of 1912, is the largest of these reinforced concrete arches yet built. The main arch has a span of 300 feet 4⅞ inches. The bridge is 670 feet long, 50 feet wide with two 10-foot sidewalks, and is 110 feet above the ground. There are two arch ribs, 30 feet apart, as seen in Plate IV, each 8 feet wide, 6.5 feet deep at the crown and 11 feet at the springing line.

The concrete was reinforced with Mueser Diamond bars except the arch ribs, where structural shapes were used. Gravel aggregate was used below the ground level and crushed limestone above. Expansion joints for the roadway were located at the abutements, the main piers and the third columns from the main piers.

The bridge contains 9,471 cubic yards of concrete and cost $170,000.

In the designs of the bridges just described much attention has been paid to their artistic appearance, more than is usual in city work. Economy in construction in order to keep within appropriations or debt or taxation limits often prevents proper attention to the artistic features, and, while none of the bridges shown are monumental in their style of architecture they are distinctly pleasing and are sufficiently different in design to prevent the criticism that they conform only with the demands of utility, which would make them of a dead sameness of design.

Design for Murray Avenue Bridge

Plate V shows a revised design for a bridge on Murray avenue over William Pitt boulevard, the history of which illustrates the difficulty of fitting together a fixed appropriation and a desire for a monumental structure. The new Municipal Art Commission now passes upon designs for all bridges costing over $20,000. They desired such a monumental and artistic structure and plans were prepared for one, but it could not be built for the appropriation and more money was not available. It provided for two 117-foot spans, ring arches, spandrel walls and filled roadway with the attendant difficulties in maintaining the roadway, and would require 9,400 cubic yards of concrete and 834,000 pounds of steel reinforcement.

The design shown in Plate V is for a reinforced concrete arch bridge 375 feet long, 60 feet wide, with two 10-foot sidewalks on cantilever brackets, the main span being 210 feet with rise of 35 feet, depth of rib at crown 5.5 feet and at springing line 11 feet, there being two arch ribs each 10 feet wide and 33 feet apart on centers. It is quite similar in design to the Meadow street bridge, Plate I, requiring 4,500 cubic yards of concrete and 400,000 pounds of steel reinforcement. The estimated cost is $40,000 less than that of the first design and it has no spandrel filling to trouble the roadway and its drainage.

Design for Haights Run Bridge

The appropriation for Haights Run bridge, shown in the heading to this article is $150,000. As it will have but a single span of 195 feet and a rise of 25 feet, there is more opportunity to give special attention to the architectural features. This bridge is on Butler street at the intersection of the boulevard, park drive and Nineteenth street bridge to Sharpsburg over the Allegheny river. It

is an important step toward building a suitable entrance to Highland park from Butler street. A design is, therefore, demanded which will be in harmony with the beauty spot by which it will be surrounded, and at the same time take care of the business traffic. The bridge will have a width of 60 feet, divided into a 36-foot roadway and two 12-foot sidewalks. Two arch ribs will support the roadway.

PLATE III. *Atherton Avenue Bridge over Pennsylvania Railroad, Looking Northwest.*

At the left (west) end will be located, as shown in the photograph of the plan, two large ornamental pylons of concrete and stone, and the railing will be of particularly ornamental design; this conforming with the comprehensive plan for an adequate park entrance.

These last two bridges will be constructed in 1913.

These bridges are designed and constructed by the Department of Public Works, of the city of Pittsburgh, thru its Bureau of Construction, of which N. S. Sprague, M. Am. Soc. C. E., is superintendent, to whom we are indebted for the photographs and information included in this article.

Engineering and Architectural Principles Followed

In a recent paper Mr. Sprague has the following to say regarding the principles followed in the designs:

"In making the plans for the large concrete bridges the principal dimensions and general type of bridge were determined largely by the profile of the ground and required certain forms of construction which could not be changed, however desirable it might be in order to give better lines to the structure. The architecture on some of these bridges, broadly speaking, was divided into two classes: First, the best architectural treatment possible to such parts of the bridge as were fixed by scientific principles of design or local conditions which could not be changed, and second, those embellishments which add nothing to the strength, serve no useful purpose, but which add greatly to the beauty and grace of the structure. The first class adds little additional cost, but the second class will in general greatly increase the cost of the structure. Having satisfied the utilitarian requirements, many modifications are frequently required to produce an artistic looking structure. Theoretically the best manner of procedure is the adjustment of the type of bridge to the site under consideration. Graceful and pleasing lines can be adopted in all cases, even where the necessity for the strictest economy prevails. Where funds are available and where conditions make it desirable, strict conformance to architectural features and precepts are most commendable."

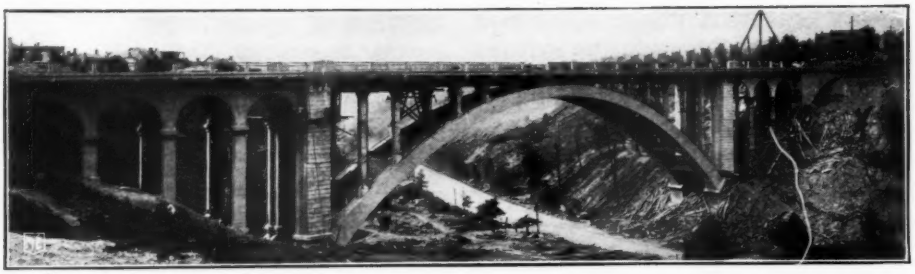


PLATE IV. *Larimer Avenue Bridge over Washington Boulevard, Looking North.*

Good Workmanship Demanded

Mr. Sprague emphasizes the necessity of thoroly good workmanship in construction in the following words:

"However carefully and accurately designed a concrete bridge may be, the work of the designer may be set at naught by delegating the construction to incompetent, inexperienced and unskilled contractors. A large bridge is an imposing and monumental structure, generally used and seen daily by thousands of people, which emphasizes the importance and makes necessary for the engineer to require the same degree of excellence of workmanship and skillful management as the architect demands in the execution of his plans for some magnificient building. The problem of the engineer in this respect is much more difficult of attainment than for the architect, since on concrete bridge construction most of the work is performed by unskilled labor and with the use of more difficult materials. A large concrete bridge is composed of a number of large monolithic sections, which must of necessity be built in several parts at different times and under varying conditions, all of which demand the utmost attention and watchfulness to the adequate bracing of the forms and their true and correct alignment. The bulging of a form or the unnoticed escape of grout from the concrete are defects which may not impair the strength of ordinary construction and which are easily remedied in most forms of concrete work, but in bridge work these accidents are liable to result in ruining the appearance of the whole bridge."

Experiments on Surface Finishes for Concrete

A very important and troublesome detail in the finish of concrete structures in accordance with the demands of art is the treatment of the surface. Mr. Sprague has made some pronounced advances toward the solution of the problem of securing pleasing surfaces for concrete which he discusses and describes as follows:

"Closely related to the importance of good workmanship on concrete bridges is the question of concrete surface finish. This may seem like a relatively unimportant matter to some engineers and a detail which is unworthy of their serious consideration; this is undoubtedly true for some structures, but the writer is convinced that if the general use of concrete for bridges, buildings, towers, etc., is to continue, its future use for these structures will depend in no small measure upon the ability of the engineer to produce effects in the surface finish of the concrete which will compare favorably and furnish an equally good contrast with other kinds of building materials. There is here open a large and profitable field for investigation and experiments along this line. The smooth concrete surface with its uniform color is lacking in character and individuality, which makes it desirable to roughen the surfaces and expose the stone in the concrete or else incorporate into the mass materials other than those ordinarily used in its composition. I am of the opinion that the ultimate solution of this most important question will be found in this manner, rather than by the applica-

tion of external treatments. In some cases the writer has been successful in obtaining good results by bush-hammering the concrete with a hammer having about 11 points to the square inch. This method of finishing the concrete surface requires the use of broken stone aggregate instead of gravel and considerable skill on the part of the workmen to obtain a uniform finish and prevent chipping the corners.

"With a view of improving and of producing a greater contrast and a more pleasing appearance in concrete surfaces upon different parts of the bridges, we made some experiments with blocks of concrete, using broken red bricks, brick dust and Ligonier limestone screenings for the aggregate instead of gravel and broken stone. Three blocks of concrete were made using different aggregates.

"Sample No. 1 was composed of 1 part of Portland cement, 2 parts brick screenings, varying from dust to ¼-inch, and 4 parts of broken brick graded from ¼-inch to 1½-inch.

"Sample No. 2 was composed of 1 part Portland cement, 2 parts limestone screenings, graded from dust to ¼-inch, and 4 parts of broken brick, graded from ¼-inch to 1½-inch.

"Sample No. 3 was composed of 1 part Portland cement, 2 parts Allegheny River sand and 4 parts broken brick, varying in size from ¼-inch to 2½-inch. Twenty-four hours after the pouring of the sample blocks of concrete the forms were removed and they were allowed to season for a period of thirty days. The surface of the blocks were then bush-hammered with pneumatic hammers having about 11 points to the square inch. The outside skin of the concrete was removed to expose the brick used in its mixture.

"Sample No. 1 presented a uniformly dark red brick color.

"Sample No. 2 presented a mottled surface of gray and red.

"Sample No. 3 resulted in the usual gray color of concrete, mottled with red, which gave little contrast and was unsatisfactory in appearance.

A Successful Surface Finish for Concrete

"The result of these experiments were so satisfactory that it was decided to incorporate concrete, made in this manner, into certain parts of the Hoeveler street bridge. This bride, which is now practically finished except the paving, is located in the East Liberty section of the city. It is a small bridge, 154 feet in length, with a single arch ring having a span of 60 feet, with spandrel walls and a filled roadway. The specifications required the contractor to use concrete of various aggregates for the different parts of the bridge, as follows:

"The concrete for the arch abutments below the ground line and for the footings of the abutment side walls shall be composed of 1 part of Portland cement, 2½ parts sand and 5 parts gravel.

"The concrete for the arch ring above the ground line shall be composed of 1 part Portland cement, 2 parts sand and 4 parts broken stone.

"The concrete in the abutment side walls above footings, except posts at end of walls and the ornamental top and inside face of parapet walls, also the spandrel walls over arch, except ornamental top and inside face of parapet walls and seal over crown of arch shall be composed of 1 part Portland cement, 2 parts brick dust and 4 parts broken brick.

"The concrete for the posts at ends of abutment sidewalks and the ornamental top and inside face of parapet walls over abutment sidewalls and spandrel walls, excepting seal at crown of arch shall be composed of 1 part Portland cement, 2 parts Ligonier screenings and 4 parts broken brick.

"The concrete for the seals over the crown of the arch shall be composed of 1 part Portland cement and 2 parts Ligonier screenings.

"The following specification was used for the broken brick, brick dust, broken stone and Ligonier screenings:

" 'Broken Brick—The broken brick used as aggregate shall be crushed, hard burned, dark red brick of uniform color. The crushed brick shall be of graded sizes, the largest of which must pass thru a one and one-half (1½) inch mesh screen and the smallest must be retained upon a one-fourth (¼) inch mesh screen.

" 'Brick Dust—The brick dust shall be

made from the same quality of brick as broken brick and shall pass thru a one-quarter (¼) inch mesh screen. The use of soft or yellow brick for either broken brick or brick dust will not be permitted.

" 'Broken Stone—The broken stone used as aggregate in concrete shall be fragments of hard, durable stone broken so as to pass through a screen having one (1-inch) inch mesh and be retained on a screen having one-quarter (¼-inch) inch mesh and be evenly graded from fine to coarse.

" 'Ligonier Screenings—The Ligonier screenings used in the ornamental scrolls and wearing surface of sidewalks shall pass thru a screen having two (2) meshes per lineal inch and at least seventy (70) per cent be retained on a screen having ten (10) meshes per lineal inch.'

"As to the result of this experiment opinions seem to differ. From an artistic point of view it has been pronounced a great success, and one eminent railroad engineer who viewed the work disapproved of the whole idea. Personally, I think we have achieved something which will at least lay the foundation for future designs and which has overcome in some degree the objection raised by many to the general use of concrete for building purposes on account of the difficulty in obtaining a suitable contrast in its texture."

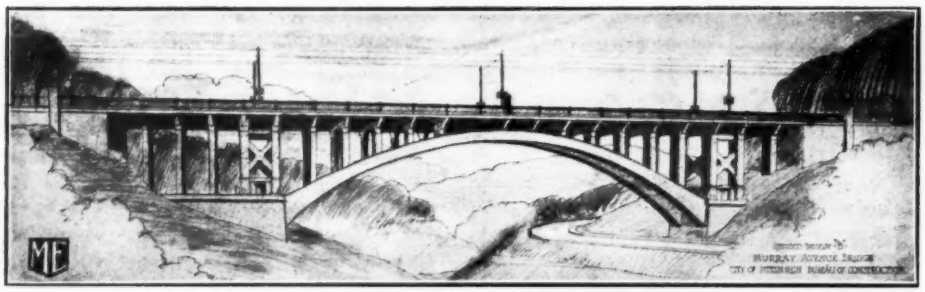


PLATE V. *Design for Murray Avenue Bridge over William Pitt Boulevard.*

MACOMB WATERWORKS A MODEL FOR SMALLER CITIES.

The city of Macomb, Ill., has now a waterworks system, equal to any in the states, completed at a cost of about $50,000, including a 112,000-gallon-capacity standpipe, just brought into service. Water is secured from Lamoine River, commonly known as Crooked Creek, a distance of a mile from the business district. The standpipe is in close proximity to the pump house, located near the dam, and with the modern machinery a very satisfactory pressure is apparent at all times, 85 pounds being maintained, which is enough to throw water 85 feet high from a fire department hose. This is amply sufficient, as the highest structures are only 65 feet in height. The plant's capacity is a million gallons daily, but only 300,000 is being used in the city. J. M. M. Keefer, retiring mayor, estimates that the system will easily clear the city $5,000 yearly. The system which this displaced has cost the city $3,000 yearly. By the old method, with improper machinery, the city was supplied with water from deep wells. The water was not considered especially healthy either. City Chemist Drake keeps in close touch with the engineer at the waterworks and advises on the mixing of the filtering compounds at different times, as for instance when the creek is muddy and also when water is colored by leaves, etc. This insures good, wholesome water for the city at all times.

FAILURE OF NASHVILLE RESERVOIR

An example which demonstrated that a slight additional initial cost for proper water-proofing might have prevented a costly failure.

THE water works reservoir at Nashville, Tenn., is an approximate ellipse in plan, its walls being drawn as circles with 356 and 187 feet radii, so that it is 603 feet long and 463 feet wide inside. It is divided into two equal basins by a straight wall across the short dimension. It was built in 1888 and 1889. The reservoir is located on top of a limestone hill in the southeastern part of the city, 277 feet above the Cumberland river and from 100 to 200 feet above the various levels in the city. The capacity of each half, with water 31 feet deep, is about 25,000,000 gallons.

The outer walls were built of stone taken off the top of the hill above the present bottom of the reservoir and are of rough ashlar laid with Louisville cement mortar of 1 cement to 2 sand. Some concrete is used in the central portion of the wall, partly for economy and partly to reduce leakage thru the wall. This concrete is irregular. The wall and concrete seem to be of good average workmanship and materials and are strong enough for their regular duties. The outer wall is 33 feet 9 inches high and 22 feet 9 inches thick at the bottom and 8 feet at the top, the curves of the vertical section being circular arcs of 74.36 feet radius on the outside and 64.6 feet on the inside. The division wall is 8 feet thick at the top and both sides are circular arcs in vertical sections of 74.36 feet radius.

The material excavated from the top of the hill which was not used in building the walls was dumped around the outside, forming a driveway entirely around the reservoir. This fill is supported by the outcropping edges of the layers of stone forming the hill, the outer wall of the reservoir being located quite near the outside edge of the layers outcropping just below the level to which the hill was taken off to form the bottom of the reservoir. The water in the reservoir is all above the finished ground surface.

It develops now that the layers of rock are not horizontal, but dip quite uniformly some 3 to 4 degrees from the horizontal, toward the northwest, except that at the southeast side where the break first occurred there is, according to the report of A. H. Purdue, the state geologist, a small fold which produces a dip of 8 degrees in the southeasterly direction, and away from the center of the reservoir. The wall on this side stood on this area of reverse dip.

The rock layers underneath the reservoir, as shown by the breaks made by the accident which occurred near midnight, November 4, 1912, are alternately limestone and shale, of varying thickness. The shale weathers to clay and water leaching thru it would have the same effect.

Such being the conditions, the reasons for the accident referred to may be readily inferred.

The walls of the reservoir have always leaked to a greater or less extent. The western half of the reservoir, now serving the city, now shows some leakage thru its wall and the surface of the ground near the foot of the wall was quite wet when it was inspected the last of December, partly, perhaps, because of recent rains, altho farther out the ground was nearly dry. It is probable that similar, and perhaps greater, leakage took place thru the bottom of the reservoir, which was not uniformly well covered with concrete and was not specially treated to prevent leak-

age. After some 24 years of use this leakage and the seepage of the water thru the shale layers has turned some of them into clay, and, evidently, an 8-degree dip was too great for the stability of the layers under the pressure of the weight of the wall and the water behind it, and a slip took place which carried the foot of the wall out and broke it in at least three places within a length of about 160 feet.

Plate I is taken to show the outcropping layers of rock exposed by the flood of water running down the hill from the broken reservoir. The indications are that the dip of these layers is down into the hill and to the right, which is that of the layers generally, and that the fold with dip in in the opposite direction, described by Mr. Purdue, was located under the part of the wall that failed. In the background of Plate I are seen the undisturbed wall of the reservoir on the right and one of the broken sections on the left. The mass of broken rock and soil washed away by the flood from the break is indicated by the pile remaining on the extreme left.

Plate II shows the end of the broken section seen in Plate I and the next broken section to the left. The quality of the masonry is indicated, also the slipping out of the bottom of the wall, which tipped the top back toward the reservoir. The third section, still further to the left, which is smaller and is overturned, would show this still more clearly. The bottom of the section in the foreground of Plate II has some four feet of the foundation rock attached to it and the outer toe of this mass has been raised several feet above its original position in the process of sliding out and tipping back. The clay and shale layers were clearly seen on inspection and the weak place seemed to be about four feet below the bottom of the wall in a layer some three or four feet thick which was made up of thin alternate layers of limestone and shale converted largely into clay, so thin that the mass was easily broken up when the softening of the clay lubricated the areas enough to overcome the resistance of the friction of stone upon shale and thus permitted movement under the pressure of the wall above and the water behind it.

The opposite (north) wall of the east basin of the reservoir can be seen on the left of Plate II and the surface of the mud on the bottom is also visible.

Plate III is from a photograph taken from about the same location as Plate I, but in the opposite direction, and shows the force of the flood in carrying rock down the hill and moving houses in its course. The street car tracks in the foreground had been cleared of several feet of rock before this photograph was taken.

Plate I was taken looking nearly west and in the track of one of three streams which flowed from the reservoir. Plate IV was taken looking northwest in another of the streams and shows the force of the water in carrying vast masses of rock for long distances down the hillside. The break in the reservoir is dimly seen in the background, the hole left by the overturning of the third broken section showing clearly and the sections seen in Plate II, less clearly.

There were apparently two sources of weakness in the reservoir; lack of sufficient depth of foundation and at the same time distance to the edge of the rock formation; and insufficient provision for prevention of leakage. Rudolph Hering, who was called in consultation, considers that the former can be taken care of at the point of the break and need not be feared elsewhere, provided the inner surface of the reservoir is waterproofed so that no more water can leak thru the shale layers below, and this looks very reasonable under the present conditions. It must not be forgotten, however, that the general dip of the rock is down in the direction of the unbroken half of the reservoir and that the general tendency to slip is in that direction, which is nearly opposite that in which the slip actually took place. The degree of dip may be sufficiently less so that the friction will not be overcome, but the observed increase and reversal in dip makes one wonder whether there may not be some other spot whose weakness may develop later if there is not complete success in

FAILURE *of Nashville Reservoir.*

Looking up hill to broken wall. Note wash by flood and the edges of rock strata.

Looking down hill from same spot. Note stone carried down and wrecked houses.

Two broken segments of dam.

Looking up hill thru another flood channel. Note destruction and size of stones washed down. Breach in reservoir wall in background.

waterproofing the reservoir or if the foundation is not made more secure by buried retaining walls outside the present foundations or otherwise.

If the reservoir had been waterproofed when it was constructed it is probable that the weakness which caused the accident would not have developed.

We are indebted to the Tennessee State Geological Survey for the photographs showing the break and some of its consequences.

A break in one corner of the lining of the new reservoir of the Johnson City, Tenn., water supply, which was filled with water on January 8, and failed January 10, is probably another example of the desirability of thoro waterproofing of reservoir linings. This small reservoir, 4,000,000 gallons capacity was located on a limestone hill which had caverns of greater or less size in it. One corner of the reservoir ran out over an earth foundation. The sides and bottom were lined with 8 inches of concrete reinforced with ⅝-inch twisted rods, 18 inches between centers, both ways. The lining was not waterproofed but was intended to make the reservoir water tight, being 1:2:4 broken stone concrete from limestone on the ground. The joint where the concrete of the bottom joined the lining of the side slope was not good and it seems that the water leaking thru carried the earth of the foundation away thru crevices or small caverns until the weight of the water was greater than the unsupported concrete would bear and an irregular hole about 8 feet wide by 6 feet high was broken in the lining of one side at the junction of two sides and bottom. After the water had run out it was found that the earth had been washed away 35 feet straight down and about 30 feet under the reservoir floor. The water did not run out over the surface immediately, but came out of the hill some 35 feet below the level of the bottom of the reservoir and nearly 200 feet away. Again a watertight lining would probably have prevented accident, altho it is evident that there were other possibilities of failure.

BALTIMORE THE CITY OF PARKS

By Stuart Stevens Scott.

Thomas Swann, Mayor of Baltimore in 1860, conceived and put into practice a plan of taxing the Street Railway Company for the maintenance of public parks. As a result of this plan the net cost to Baltimore for its 2,266 acres of parks has been less than $10,000.

ALTHO Baltimore is better known as the "Monumental City," an equally appropriate name would be "The City of Public Parks," for there are, perhaps, no cities in the country that have better parks and none that enjoy as great an area of breathing space with as little cost to the taxpayers.

Washington Monument. Mt. Vernon Place.

Indeed, Baltimore's breathing spots, numbering forty-seven, with a total of 2,266.22 acres, have cost the city in the neighborhood of but $10,000, which was expended for some new buildings in 1901. Prior to that time, and since, the cost of acquiring park acreage and the maintenance has been taken care of by the street railways.

A Far-Seeing Mayor

In 1860, Thomas Swann, who was mayor of the city, had before him several applications for franchises to lay passenger railway track in the city. Mayor Swann conceived the idea of stipulating in the franchise that the street railway company should perpetually pay to the city 20 per cent of the gross receipts and that this money be used for the purpose of purchasing and maintaining parks. The franchise was accepted and the first year of the operation of the street cars netted the city $33,000. In later years, however, after several changes in the price of transportation, which had ranged from 5 to 7 cents and charges for transfers, by a vote of the people in 1870 the cars were permitted to run on Sunday and there was a readjustment to the present fare of 5 cents with free transfers and a tax of 9 per cent on the gross receipts.

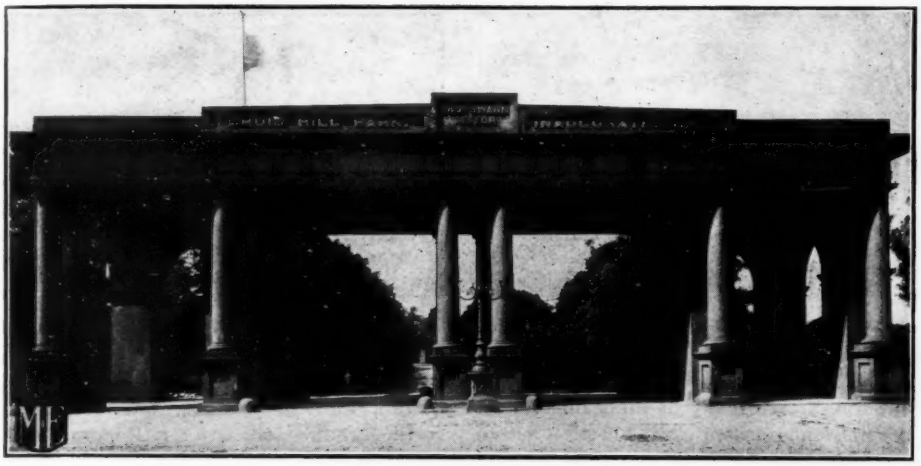
These gross receipts are increasing annually and the 9 per cent tax for 1911 brought to the coffers of the park board $514,697.56. In addition to this revenue the park board has an annual rental income from privileges that brings in about $3,000, while a similar amount is derived from the sale of hay, sheep, deer, worn-out equipment, etc., all of which brings the grand total up to about $600,000.

A Park System

In 1903 the Municipal Art society, a public-spirited organization that has been responsible for a number of excellent beautifications, employed Olmsted Brothers to visit Baltimore and to make a report, not upon the park system as it then existed, but upon what should be done for future development.

Messrs. Olmsted spent several months on the work and their report, issued in 1904, was such that it was adopted by the park board, which not only insisted upon paying for the report, but determined to carry out, as rapidly as warranted, the recommendations.

This new system at once gave to Baltimore something definite to work upon and the carrying out of the Olmsted plans is now in progress. To jump right into the work, to acquire necessary land and to make permanent improvements the people of Baltimore voted a loan of $1,-



DRUID HILL PARK, BALTIMORE, MD. *Main Entrance.*

000,000. This loan, incidentally, will not have to be repaid by the people, but will be taken care of by the annual street car tax.

Having always had at its command a fund of ample proportions, the several park boards have never been niggardly in their expenditures. The result is that Baltimore today has as beautiful parks as any city in this country. For natural beauty Druid Hill park, with its seven hundred acres and scores of miles of splendid macadam roads, has long been acknowledged the finest natural park east of the Mississippi river, while Mount Vernon place, at the base of Washington's monument, ranks as one of the most beautiful spots of its kind in this country.

Historical

The entire history of Baltimore's park system is interesting. Every step that has been made since Dr. George Buchanan wrote an open letter on June 22, 1790, indicates the spirit of unselfishness and generosity of those who have helped to make the city's great park system possible.

Dr. Buchanan's plea for a park was based upon the idea that children should have proper playgrounds. His letter was hardly published before Colonel John Eager Howard threw open his large wooded estate on the edge of the city and invited the people to use it.

For half a century Colonel Howard's estate, then generally known as Howard's park, served the public purpose.

In 1812, the city bought its first public park, comprising about an acre of ground on which is now Calvert street. This land and improvements cost $27,000. In later years, however, when the park was abandoned and sold, this expenditure was made good.

In 1827, William Patterson deeded to the city 37 acres of land which was then a mile or more beyond the eastern limits of the city. The city rapidly grew toward this park and the city authorities, looking to the future, kept adding to it until today the park contains 128.44 acres; also, it is now surrounded by dwellings and is in the corporate limits.

The acquiring of Druid Hill park is one of the incidents that will always stand out brightest in the civic history of Baltimore.

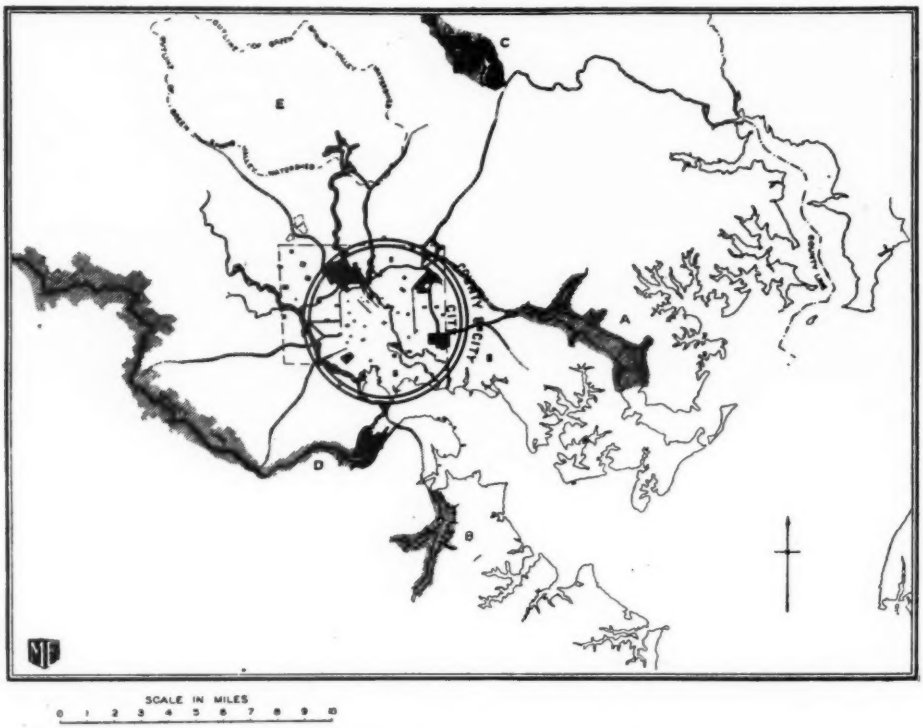
In 1860, Mayor Swann appointed a commission to acquire for Baltimore a park

Conservatory on Main Driveway.

Mount Royal Avenue, leading to entrance to Druid Hill Park.

Broadway, with Eastern Female High School on left.

that would be worthy of the name. This commission selected the 500-acre estate of Lloyd N. Rogers, a property that at that time ranked as the finest private estate in America. The price that Mr. Rogers wanted, $510,000, was acceptable to the commission, but Mr. Rogers didn't think enough of Baltimore to take more than three-quarters of his payment in city stock, demanding the remainder in cash.



BALTIMORE'S PARK SYSTEM, PRESENT AND PROPOSED. *Solid black indicates public grounds. Shading indicates proposed public grounds.*

A. *Black River Reservation, partially acquired.*

B. *Curtis Creek Reservation, none acquired yet.*

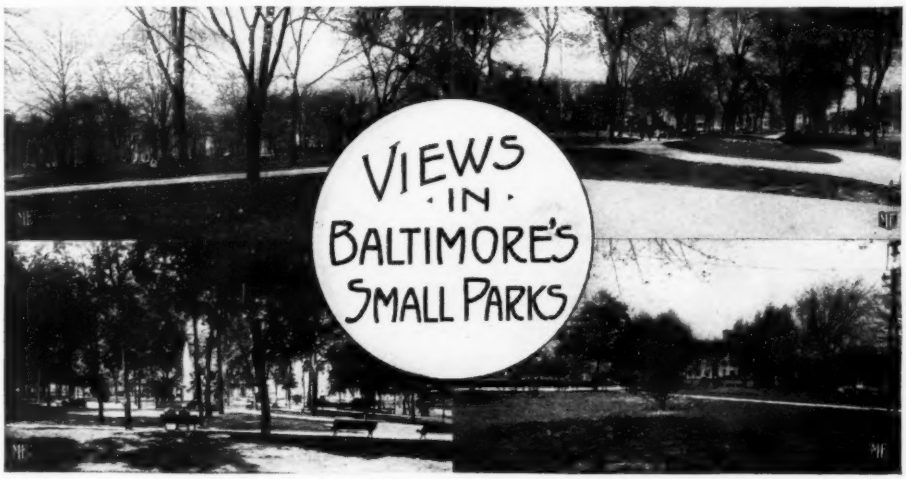
C. *Loch Raven, site of new water works, to be parked.*

D. *Patapsco Gorge, partially acquired.*

E. *Green Spring Valley, a suburb given over entirely to magnificent private estates.*

March, 1913.

Eutaw Place, leading to entrance to Druid Hill Park.



Lafayette Square.

Madison Square.

Harlem Park.

Johnson Square.

Lake for Boating and Skating.

Spring fountain in Clifton Park.

A woodland scene in Wyman's Park.

The difficulty of raising the cash was overcome by Mayor Swann and ten other citizens subscribing $10,000 each.

It is gratifying to read that this stock rejected by Mr. Rogers immediately jumped in value. When the stock became due in 1890, it was not only redeemed by the sinking fund that had been provided thru the taxation on the street railways, but this fund placed to the credit of the park board a balance of about $175,000. From time to time the area of Druid Hill park has been increased until it now contains 672 acres.

Parks are for the People

The parks of Baltimore are for the people. Save in the small squares and at the entrance to the large parks the "Keep-off-the-Grass" signs are conspicuous by their absence. In all of the parks are picnic groves, tennis courts, baseball diamonds and heaps of sand, the latter for the toddlers. The Baltimore Playground association and the Baltimore Public Bath commission carry on their work with the co-operation of the park board.

In Patterson park, there is a modern athletic field with swings and other apparatus and a bathing pool.

March, 1913.

A NOVEL BRIDGE

By J. O. Bashford, Tacoma, Wash.

THERE has just been completed at Tacoma, Wash., a steel lift bridge that presents several new features in engineering. It is believed to be the first bridge built with a lift span lower at one end than at the other. This lift is 214 feet between piers and is 5½ inches lower at one end than at the other.

Work on the construction of this bridge was begun about eighteen months ago. The bridge spans the city channel at Tacoma and connects the manufacturing district with the business center. It replaced a steel bridge, constructed a number of years ago and which had outlived its usefulness.

In order to keep the way open for traffic it was necessary to use the old bridge while the new one was under construction. To do this the contractors built a temporary bridge beside the old one but crossing it so that its ends are on opposite sides of the old bridge. The old draw span was left intact and was swung at an angle to connect the ends of the temporary bridge. While this was under construction work was under way on the concrete piers for the new bridge, on which about 1,200 yards of concrete were used. They were sunk fifty-five feet below the channel bottom to a firm foundation. The tops of the piers are over 70 feet across.

One of the approaches to the bridge leads from a high bluff and the approach from that side, with the lift is on a 2½ per cent grade.

The lift span, which weighs 800 tons is handled by a 60-h. p. motor. The counter weights, which are of concrete, weigh 400 tons each and are held by 64 steel cables; 16 of these cables at each corner measure 1½ inches in diameter. The span is 60 feet above the water at high tide and lifts 75 feet. The span can be raised this distance in 30 seconds. It is also arranged with a hand-power gear for use when the motors are disabled.

NOVEL LIFT BRIDGE *at Tacoma, Wash. Note water pipe at top of lift towers and temporary bridge crossing under the new bridge.*

To solve the problem of handling the heavy water main in this district the suggestion was made to carry the pipe over the bridge. This has been done and a 14-inch water main is swung by a trestle work over the top of the main lift and carried 213 feet above the surface of the water below.

The bridge was built by the International Contract Company at an estimated cost of $500,000. It was designed by Waddell & Harrington, of Kansas City. The steel was furnished by the American Bridge & Dredging Company.

TAKING CHANCES ON A SEWER TRENCH

THE necessity of eternal vigilance in sewer excavation is emphasized by a fatal accident on a sewer trench in Birmingham, Ala., on the evening of January 3, 1913.

FATAL ACCIDENT *in Birmingham sewer trench; view of cave-in on each side of trench, earth surcharge on left, and water pipe, partly suspended in trench and partly dropped out. Photograph taken while digging for buried laborers.*

The city is constructing a 5-foot main outlet sewer of brick, nearly all of which had been completed. The contractor was working on a section connecting the constructed line on the lower, southeastern side of the street railway line between Birmingham and South Ensley and the completed upper line on the northwestern side of the Pike Road paralleling the tracks, as shown on the accompanying photograph of the plan of the same. The curves in the road were excavated and in process of excavation with a depth of cut of about 20 feet. The street railway tracks are 3 or 4 feet lower than the level of the road in the vicinity, as shown in the cross section of the cut.

The soil, as may be seen by the photographs of the trench taken after the accident, is stiff and clayey and stands vertical under almost any conditions for any depth of excavation. The only bracing observed was some 12-inch planks set vertical and several feet apart, with light cross braces sufficient to hold them in place, but not sufficient to resist any material motion of the earth.

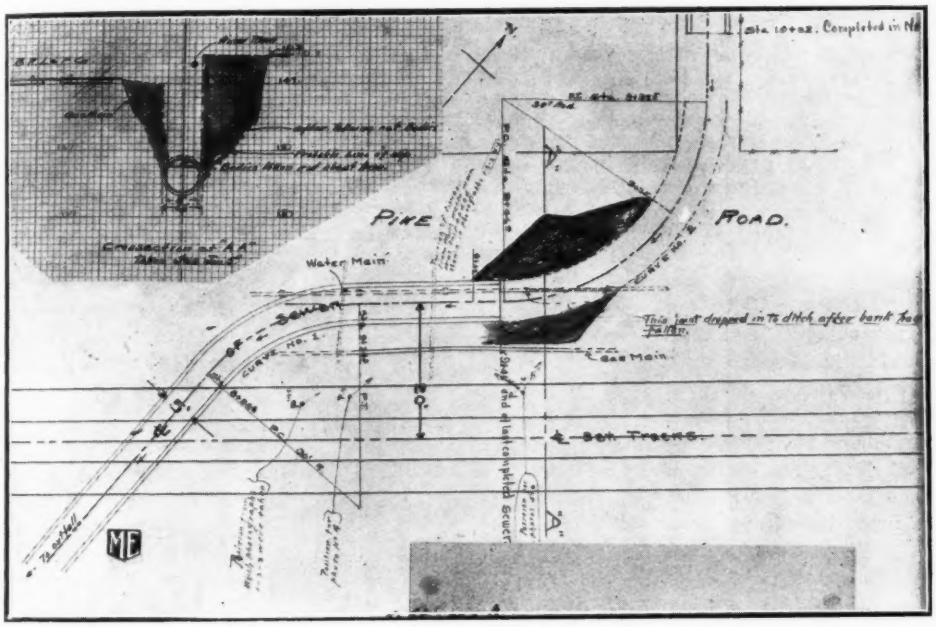
The Pike Road was closed to travel, but cars were running regularly on the street railroad tracks. There had been considerable rain at frequent intervals for some time prior to the accident and on the afternoon of January 2 there was a particularly heavy rainstorm which seems to have caused the small slide on the side next to the car tracks. The old trench for the gas main and the vibration due to the passage of cars doubtless aided in causing this slide, which was not serious, nor did it lead to any effort to brace the trench thoroly. On January 3 only a few minutes before quitting time in the evening the heavy slip occurred, which buried about 20 negro laborers, six of whom were killed. It required all of the next day to recover the bodies. The writer saw the trench on Sunday, January 5, the day on which the measurements for the accompanying cross-section were taken for the city engineer's department, as shown by the full line marked "After taking out bodies."

As shown in the plan, section and photograph, a water pipe was located in the trench and was supported by timbers across it. One unsupported length of this pipe dropped into the ditch after the bank slipped in under it. The earth excavated from the trench was all thrown out into the road on the higher side of the trench. The plan and profile are self-explanatory.

The accident seems to have been caused by the softening of the bank by the rain, particularly the heavy rain of January 2, and the heavy weight of the excavated

earth undoubtedly aided in causing the slip. It occurred on the curve where the bank had the least lateral support. Quite possibly the slip would not have occurred if any one of these three contributing causes had been lacking.

The accident is another warning that the sides of excavations cannot be watched too carefully, and the effect of any unexpected occurrence upon their stability must be carefully estimated and provided for.



PLAN OF SEWER TRENCH *in Birmingham, Ala., and sections showing circumstances of fatal accident.*

CHICAGO BUDGET FOR 1913.

Chicago's annual appropriation bill for 1913, carrying a total of $65,032,124.66, has been passed by the city council. When the last of the changes had been figured out and the new total secured it was found the council had made a net increase of $870,539.31 over the budget as recommended by the finance committee.

The comparative figures of the budget committee as recommended and the appropriation bill passed by the council were:

	Budget.	Appropriation.
Corporate Purpose fund....	$23,384,197.07	$23,735,909.38
Water fund....	8,136,828.70	8,271,446.70
Bridge Bond fund	3,982,646.00	4,149,464.70
Contingent on Bonds	5,623,220.00	5,623,220.00
From Traction Deposits	184,000.00	184,000.00
Sinking fund...	1,829,609.58	1,829,609.58
Public Lib.....	851,640.00	851,640.00
Tuberculosis Sanitarium ..	945,000.00	945,000.00
School Purposes	18,941,250.00	18,941,250.00
Voting Machines	283,335.00	585.00
Totals	$64,161,545.35	$65,032,124.66

The only figures changed by the council were those of the corporate and water funds and the bridges. All others remained as the committee had recommended. The coporate appropriations were increased $352,296.31, water, $134,618, and bridges, $167,000.

The big increase from the corporate fund included $211,303 for park judgments, $63,895 for police, $5,140 building department, $4,864 board of local improvements, $11,062 special parks, and $69,144 electrical department.

GUARDING AGAINST ACCIDENTS

By Robert J. Young, Manager Department of Safety and Relief, Universal Portland Cement Co. and Illinois Steel Co.

THE following article has a direct bearing upon the work of every contractor and employer of labor where the men have more or less influence upon each other's safety. One main idea is continued advertisement of the possibilities of guarding against accidents and making men familiar with them so that they will always know what to do, and more important still, what not to do. Another is emphasis of the importance of guarding against accidents which is a state of mind into which the contractor must first put himself, then force his superintendent and foremen into the same state of mind, when the men will follow. While but little of the apparatus shown is applicable in any one case the spirit is applicable everywhere, and that is the spirit of this article. [EDITOR.]

The desirability of preventing industrial accidents is receiving a great deal of deserved attention, and for a number of years the subsidiary companies of the United States Steel Corporation have been carrying on a campaign for the safeguarding of machinery and other dangerous places, under a committee known as the "Committee of Safety of the United States Steel Corporation," which was appointed in March, 1908.

Robert J. Young.

In handling this work the Universal Portland Cement Co. has divided it into three closely allied headings, viz.:

1. The Safeguarding of Dangerous Places.
2. The Promulgation of Rules for Safe Operation.
3. The Inculcation of Habits of Caution in the Minds of All Concerned.

The Safeguarding of Dangerous Places

It might be said in this connection that although statistics show that failure to guard dangerous places is not the most prolific source of accidents, carelessness in this regard has a most marked effect, consciously or unconsciously, upon our thoughts and actions, and is, therefore, conducive to reckless habits.

What folly it would be to try to enforce or train the workmen into thinking of their own or others' safety, if we did not show our desire to prevent accidents by doing all in our power to make the working conditions as safe as possible.

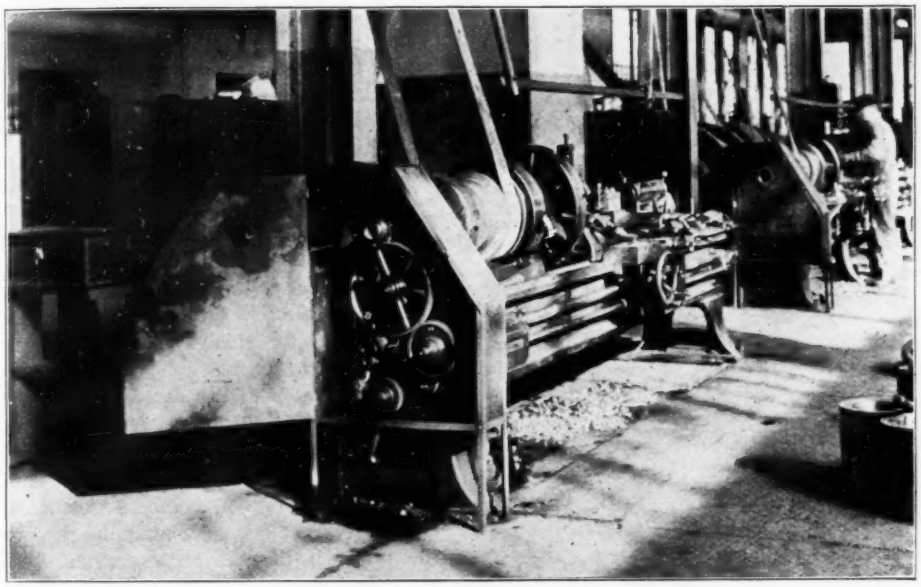
There has been a gradual development in the working out of these safety appliances. When a new kind of guard is devised, it is tried out at one of the plants until it is proven that it is efficient and practicable, and is then installed at the other plants. In this way the installation of efficient, standard guards is insured.

Every precaution is taken to safeguard workmen from injury from electrical equipment and electric current. One or two selected pictures show devices which will be of value to any one using such apparatus, and are fair examples of the many devices which have been installed.

Every motor thruout the plants is controlled by an oil switch, and an arrangement is provided for locking the switch in the open position with a padlock, as shown in cut No. 2.

This makes it impossible for any one to start up the machinery on which a re-

pairman has work to do until he is thru and has removed his padlock. If, for instance, a machinist and an electrician were both working on machinery controlled by the same switch, there would be two padlocks on this switch so that the electrician, for example, would not have to depend upon the machinist for his safety.



Method of Guarding Lathe Gears.

Cut No. 1 illustrates a lathe guard in machine shop. It is required that gears shall be covered on the sides as well as on the face and that the guards shall cover the wheels to such an extent that the danger from being caught between the end of the guard and the wheel will be eliminated.

Contractors should feel the importance of protecting their workmen from exposed gears on concrete mixers, pumping engines, hoists, etc.

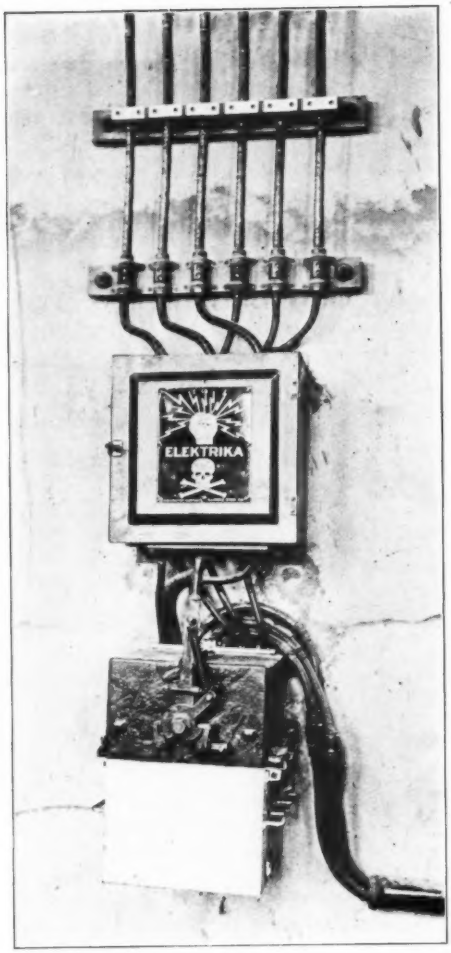
Promulgation of Rules for Safe Operation

All men are employed thru an employment office. When a man comes to the office for a job he is confronted by a sign telling him that unless he is willing to be careful of his own and others' safety he should not ask for employment.

Every man passing thru the employment office is given a rule book printed in his own language. The Workmen's Rule Book sets forth the rules and precautions that should be observed to prevent accidents. The Superintendents and Foremen's Rule Book, in addition to containing these rules, also contains construction rules, governing the construction and installation of machinery and the physical conditions to be maintained. It sets forth how gears, shafting, belts and pulleys, etc., shall be protected; what protections are required on cranes; how stairs, platforms, railings, etc., shall be constructed; in fact, setting forth the standard safety devices adopted by the company.

Inculcation of Habits of Caution

The care exercised by the workman largely enters into the number of accidents occurring in any plant, and the only way the number of accidents due to carelessness can be reduced is by the inculcation of habits of caution into the minds of the men. The burden of doing this must rest almost entirely upon the management of a plant or department. The superintendent's attitude and the foreman's attitude toward the prevention of



Lock for Switch and Danger Sign.

accidents will be reflected by the workmen just as accurately as their attitude toward the getting out of finished product is reflected. If the superintendent treats the matter lightly, his assistants will treat it lightly. If he shows a strenuous desire to have working conditions safe and precautionary rules observed; if he makes the prevention of accidents one of the most important features of his department, then his foremen will reflect that feeling and will see that the men observe the precautions which are known to be necessary to the prevention of accidents. By seeing that the men observe these precautions and by talking with them about the necessity of keeping conditions safe, they will inculcate such habits of caution that the number of accidents occurring in that department will be reduced to a minimum.

One of the plans to catch and hold the interest of the men and at the same time insure the installation and use of safeguards and the stamping out of dangerous practices is the organization of safety committees in each plant or mill, consisting of the assistant superintendent, who acts as chairman, and an operating, a mechanical and an electrical foreman. This plan can be modified to suit the conditions of the employer of labor on any work where there is danger of accident.

Regular inspections are made monthly, and in the manner of making these inspections lies the feature which has proven to be an incentive to the committee members to always have their mills in good condition.

The management has caused to be made a badge of distinction which is presented to each man showing a thorough knowledge of the safety rules. The workmen, as well as foremen, compete for these badges. It is, however, compulsory upon the foremen to take an examination on the rules and precautions governing the prevention of accidents. In order to obtain a badge it is necessary that an examination be passed with an average of at least 90 per cent. efficiency.

When records are made in production or for any reason cigars are distributed, they bear the "Universal Safety" band. If a man has distinguished himself in any way to promote safety he is rewarded with a box of the "Universal Safety" brand.

The department of safety and relief issues each month a Safety Bulletin treating on accident prevention.

The names of all members of safety committees are shown in this bulletin, with the request to workmen to help these men keep the dangerous places guarded and stop dangerous ways of doing work in order to raise the "batting average" of the plant in the Accident Prevention League. An accident chart is shown, giving the standing of each plant, showing the champions at the top, and a

"score card" is run from month to month, remarking on any changes that may take place in relation to the standing of the plants.

The bulletin also sets forth accidents that have occurred recently and points out how they can be prevented.

Cuts of safety devices designed by foremen and workmen are illustrated, and credit is given to the man who has interested himself enough in this work to devise means of preventing accidents.

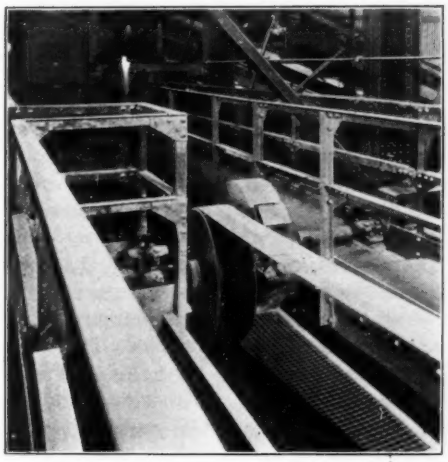
Known cases where safety devices have prevented accidents are reported, and in fact anything is put in which it is thought will interest the men and keep them "boosting for safety."

Results

That is what we are all interested in.

You frequently hear that accidents are inevitable—that they are bound to happen and that little can be done to prevent them, as the human equation is such a large factor in their occurrence.

The records of the Universal Portland Cement Co. show that thru an organized effort in guarding dangerous places, promulgating safety rules and interesting the workmen in their own and others' safety, great strides can be made in accident prevention. The accidents in that company since this organized effort was inaugurated have been reduced 66 2/3 per cent.



Guards for Gears, Shafts and Falling Articles.

DESIGN OF ROAD AS AFFECTED BY TRAFFIC

THE amount and character of traffic are both of the utmost importance to the life of a road and information about both is essential to a successful design.
both is essential to a sucessful design.

The engineer can design a successful pavement for horse-drawn traffic alone or for automobile traffic alone, and he can do the same for a country road if he takes sufficient account of the loads carried by the commercial vehicles. A city street must be designed to carry reasonably heavy loads and the speed of automobiles is kept down to a reasonable rate, so that on the one hand the weight is taken care of and on the other the speed need be considered but little, if any.

But when the engineer desires to make an economical design for a country road to carry both kinds of traffic, he is in trouble. He must have the fullest information about the kind of traffic, the number of vehicles, the weights carried, the widths of hard tires, the number of horses, the speed of automobiles, with details as to each, that he may make the necessary comparisons and allowances for the various factors of wear which affect the surface of his road so differently. Not only this, but he must turn prophet and predict the effect which the improvement of the road will have upon the traffic of the future, otherwise he may find himself in the condition of many English road officials, who are now asking for grants to strengthen the foundations of main country roads on account of the large development of heavy steam lorry and commercial automobile traffic, both heavy, and, in the latter class rapid in character.

Effects of Traffic on Roads

In a recent discussion of the traffic census, in its relation to road design, Professor A. H. Blanchard gave some interesting results of observations:

"The first case is that of a water-bound macadam road, located in an isolated district, and subjected to a traffic of 150 motor cars and fifty horse-drawn vehicles per day. The motor cars consisted of heavy touring cars, which travelled at speeds of 30 to 50 miles an hour. Within six months after construction the wearing surface had disintegrated to such an extent that the cost of reconstruction amounted to practically $1,000 per mile. It is self-evident that if a macadam surface on a residential street in a city had been subjected to this amount of traffic, moving at a speed of not greater than 20 miles an hour, very little disintegration would have taken place.

"The second example is that of a macadam road constructed of shale rock and finished with a bituminous surface in connection with which a heavy asphaltic oil was used. The road was subjected to a large amount of motor car traffic during the summer months and during this period gave entire satisfaction. In winter, however, the traffic included heavy horse-drawn vehicles used for hauling logs. As the horses were equipped with sharp calks, the effect of drawing heavy loads upon the above surface was disastrous. The road in the spring was full of holes, some of which were twelve inches in depth. The above emphasizes the value of taking a traffic census at different seasons of the year and also the value of a thoro investigation of the character of the traffic by consultation with the various interests using the highway.

"As the third illustration will be cited the case of a bituminous concrete pavement, subjected to a total traffic varying from 500 to 1,000 vehicles per day, the horse-drawn vehicles and motor cars being about equal in number. The bituminous cement used in the mix was a coal tar. The pavement was not furnished with a seal coat. The result of winter

traffic for five months was the disintegration of the surface, consisting in the formation of many pot holes. An adjacent section on which a seal coat was used was in excellent condition at that time. The disintegration in the above instance was due entirely to the horse-drawn vehicle traffic, as the blows from the horses' hoofs loosened the individual stones in the open mosaic surface of the pavement.

"The fourth example is that of a water-bound macadam road built of trap rock, which highway was subjected to a daily traffic of fifty motor cars and 100 horse-drawn vehicles. This road ravelled continuously during dry spells, due to the insufficiency of the dust, formed by abrasion, which was required to bond the road. On the other hand, a macadam road, similarly constructed, subjected to twenty-five motor cars and 225 horse-drawn vehicles per day, remained in an excellent condition. Of the 225 horse-drawn vehicles, 150 were commercial vehicles, which naturally tended to produce a certain amount of dust by abrasion and to compact the surface.

"The last illustration to be cited is that of a water-bound macadam road upon which was constructed a mat surface, formed by using a heavy asphaltic oil and stone chips. Under a traffic of 300 horse-drawn vehicles and 400 motor cars per day, the mat surface crept, forming a waxy surface. Many holes developed, caused by the blows of horses' hoofs on the mat surface.

"It is evident from the above illustration that it is also essential to keep accurate records after the construction of roads and pavements in order to have at hand complete data upon which to base the design of wearing surfaces of highways to be constructed under similar conditions."

The Information Necessary

Professor Blanchard makes a definite classification of the most essential information concerning the traffic, to be used in judging the suitability of a constructed road for the traffic upon it, as a basis for future designs, and in deciding the character of design to be adopted for a new road surface. In the latter case the estimates of future changes must also be made. We have but few histories of constructed roads, on which to base these predictions, and they are, therefore, largely guesses, with a little basis of more or less accurate observation and summation of experiences. Professor Blanchard's classification is as follows:

"(1) Differentiation between horse-drawn vehicle traffic and motor car traffic.

"(2) Division of each of these classes of traffic into pleasure and commercial traffic.

"(3) Subdivision of commercial traffic into loaded and unloaded vehicles.

"(4) Determination of the weight per linear inch of width of tire of all types of commercial traffic.

"(5) Subdivision of the two classes of horse-drawn vehicle traffic, dependent upon the number of horses.

"(6) Subdivision of pleasure motor car traffic upon the basis of weight and speed, since, in many instances, the greatest damage to certain types of roads is caused by seven-seat touring cars, limousines or landaulets, traveling at speeds of 40 to 60 miles an hour.

"(7) Extraordinary character of local traffic; for example, traction engines hauling trailers, motor bus traffic, ice wagons, mill drays, etc."

WOOD PRESERVATION WITH ASPHALTIC MATERIAL

IN an article entitled "Asphaltic Oils Economical Wood Preservers," published in MUNICIPAL ENGINEERING, vol. xl, p. 411, Frank W. Cherrington reports the success of the Sante Fe Railroad in treating ties with natural asphaltic oils from California and Mexico to prevent decay. The result is a tie with probable life of 18 to 24 years, while untreated ties of the same and better kinds of timber were removed from the track in about 6 years.

He also shows the value of refined asphaltic oils from the Central States for the same purpose. The inflammable and volatile portions having been removed by the refining process, the oil is more dense and stable than the natural oils. It has about 65 per cent asphaltic content as compared with 75 per cent in the California and 80 per cent in the Mexican natural oils. The refined oil has cementitious or adhesive qualities, which bind the fibers and cells of the wood together, strengthening it and considerably reducing the tendency to check, as well as waterproofing it and preserving it.

Mr. Cherrington has continued his studies of the oils and their use in wood preservation, and states that the results demonstrate that an antiseptic germicide is not essential when the timber is thoroughly waterproofed by an asphaltic substance which entangles and enmeshes any germ life which may be present and prevents the entrance of any fauna or flora destructive to wood.

His comparative analysis of the three oils shows flash and fire tests of the refined oil 220 degrees or so above the Mexican crude oil and 140 or so above the California oil. Density is over 7 degrees Beaume above either. Specific gravity is 0.048 to 0.046 less. Loss on distillation is zero up to 300 degrees Centigrade, whereas Mexican oil loses 20 per cent between 150 and 300 and California loses 15 per cent. Evaporation at 140 degrees F. is zero and at 200 degrees is but 0.132 in 96 hours; whereas Mexican oil loses 6.8 to 11.4 per cent and California oil 2.3 to 11.5 per cent, according to temperature and whether 24 or 96 hours exposure.

At 100 degrees F. the Mexican oil has a viscosity of 3000 with Scott's viscosimeter, the California oil 1565 and the refined aspahltic oil 100, showing that the latter is much easier to handle by pumping in pressure plants. In fact, there is little or no trouble in so handling the oil in the plants in which it has been used. The viscosity of the crude oils decreases very rapidly to 150 degrees and less rapidly thereafter, and at 250 degrees the three are not far apart, being 40.5, 22 and 16, respectively.

The asphaltic oils of the Central States can be used in producing this refined oil, but the crude petroleum of the Eastern States does not have an asphaltic base and can not be so used.

Asphaltic oils, says Mr. Cherrington, must be injected in quantity such that the wood will refuse to absorb any more to have value as a timber preservative. In practice, pine ties absorb from 8½ pounds per tie when of dense heart wood, to 80 pounds when almost entirely of sap wood. The two ties have about the same life, notwithstanding the great difference in amount of preservative used. The average injection is about 40 pounds per tie.

The absorption per cubic foot, treated to refusal, in various timbers is shown in the following list:

Hardwood Special	3.48
Sap Pine	3.00 to 7.27
Seasoned long leaf pine	9.54
Birch	2.42
Gum	9.10
Red Oak	8.66
Beech	5.45
Seasoned Elm	9.10
Seasoned Birch	4.53
Seasoned S. Elm	16.06
Seasoned Gum	15.45
Seasoned M. Oak	4.83

Seasoned Pa. Pine	9.70
Green Yellow Pine	8.18
Hardwood Special	5.45
Seasoned Beech	9.40

Three runs of about 500 ties each, mixed timbers, averaged 8.3, 7.5 and 9.3 pounds per cubic foot absorbed, respectively.

Samples cut from the ties showed penetration not so good in beech, birch and maple (hardwood special), fairly good in red oak, and excellent in loblolly and sap pine, the sapwood being completely impregnated.

The maximum amount of oil absorbed is not prohibitive on the score of cost, and the average is very reasonable. The treatment to point of refusal injects a maximum of the preservative material, which by the exclusion of moisture prevents the entrance from outside of organisms causing decay, and prevents the growth of those within the tie.

The time required to treat timber with the asphaltic oil is about 3 hours, 10 minutes, 7.58 charges per day being possible. The approximate time required to treat the same timber with 8 pounds of creosote per cubic foot is 2 hours and 35 minutes. The reduction in output of the treating plant is asserted by Mr. Cherrington to be more than made up by the marked increase in the life of the timber under the full-cell treatemnt with asphaltic oil to refusal.

The increased use of treated paving blocks makes this an important branch of wood preservation. Some city specifications demanding the use of creosote oil, with a specific gravity ranging from 1.03 to 1.1, and designating an injection of 20 pounds per cubic foot, require that after treatment the block shall show such waterproof qualities that after being dried in an oven at 120 degrees F. for 24 hours, weighed and immersed in clear water for 24 hours and weighed, the gain in weight shall not be greater than 4 per cent. A wood block treated with 16 pounds per cubic foot of refined asphaltic oil, submitted to the same test showed a gain of but two hundredths (0.02) of one per cent.

Waterproofing wood paving blocks is of the utmost importance not only to prevent decay, but especially to prevent damage by buckling of pavements. It is reasonable to assume that as good results can be obtained in preserving wood paving blocks with asphaltic oil, specially prepared, as with railroad ties. Mr. Cherrington therefore urges engineers and city chemists to investigate the asphaltic oils as materials for wood preservation. They are obtainable in enormous quantities at low prices and within easy reach of most consumers.

Design of waste can, as adopted by the committee on streets, Minneapolis Chamber of Commerce, with which the city will probably be equipped in the near future.

THE CIVIC CENTER OF DES MOINES

By George Bate Lord, Secretary of the Commercial Club.

THE Des Moines river comes down thru the business center of Des Moines, Iowa. The government years ago patented the area within the meander lines to the state and the state in turn patented the portion of the river bed within the city to the city for park purposes. For years nothing was done with the river. Junk dealers, cheap boarding houses, barns of one of the express companies, etc., occupied the river front and encroached upon the city's property.

Five years ago a committee of the Commercial Club, known as the Civic Improvement committee, started to create sentiment for river front improvement and the creation of a civic center. It induced the city to bring ouster suits against the trespassers and to acquire by purchase or condemnation all of the land between the river and First street east and First street west. This cost the city about $100,000. Next it sought improvements.

Handsome Buildings Come First.

The public library was the first building to go to the river front. It cost about $300,000. The government postoffice, costing $500,000, followed. Then came the Coliseum, costing $165,000, and then the new city hall, costing $450,000. A Federal court house, to cost $350,000, is now in sight and a movement is on foot to remove the State Soldiers' and Sailors' monument from its present location a mile east of the business center to the river front. As occasion demands them we will seek to locate other public building along the river bank.

Bridges and Lake Follow

This year $65,000 was expended for acquiring land in this district and $35,000 for parking, building a river wall, etc. The Civic committee raised $8,000 in subscriptions of $10 and $25 each with which a dam was built below the center to hold the water to a stated level in this center at all times. In the five years two

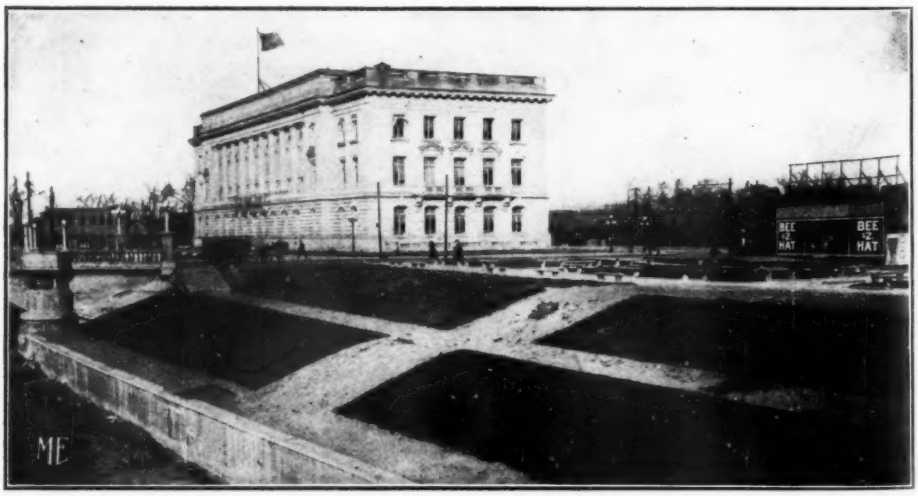


PLATE III. *The two blocks shown in Plates I and II as they appeared in 1912 with the new municipal building.*

PLATE I. *The east river front between Locust and Walnut Streets in 1909.*

PLATE II. *The east river front between Grand and Locust Streets in 1909.*

of four old overhead truss bridges have been removed and replaced by concrete arch bridges, as shown in the views. In the next three or four years we expect to replace the two other bridges with concrete structures. We also expect to make available for boating from the civic center, by using a submerged electric lift to get over a dam at Center street, a lake formed by this dam ,which extends up the river for six miles. Already the railroads are co-operating. These cross the river just below the civic center and a view of it is to be had from all trains coming into and leaving the city. They are replacing old truss bridges with panel bridges.

More Area Secured

Up stream the city has acquired by purchase and donation a strip along the west bank of the river from a width sufficient for a boulevard drive to one of several hundred feet along the river. On the east bank a park of a couple of hundred acres has been acquired extending for nearly a mile along the river. From this park west to Waveland and Greenwood parks, about three miles distant, the Civic committee has secured dedications without expense to the city of 35 acres of right of way, so distributed as to permit of the building of a boulevard. This extends along either side of a water course and thru heavily timbered ravines, where there is a natural water grade that will call for but small expenditure for grading.

The accompanying photographs show the area of the civic center before im-

PLATE IV. *The west river front, showing the new Public Library and the Coliseum from the Walnut Street Bridge.*

PLATE V. *The west river front from Locust Street Bridge, showing night view new Postoffice, Bridge and River Front Park.*

provement and its appearance at the present stage of the improvements.

Plate I is of the east river front, between Locust and Walnut; Plate II is of the east river front, between Locust and Grand; both taken three years ago. Plate III is of these two blocks as they now appear with the new municipal building.

Plate IV is of the west bank, showing the library and Coliseum. Plate V also shows the west river bank, type of bridges and character of park improvement work, with the new postoffice in background. Des Moines has an extensive ornamental street lighting system and the last two photographs are night views.

REGRADING RINCON HILL IN SAN FRANCISCO

The San Francisco Chamber of Commerce proposes to grade down Rincon Hill, which interferes materially with the use for mercantile and industrial purposes of the area most convenient to the new southerly extension of the docks in the harbor. At least three plans for the work are proposed. By the most extensive plan the area to be graded down is twenty-five city blocks. The maximum depth of cut on this plan is 61 feet at Harrison and First streets. This plan, which is most in favor, will affect 779 separate parcels of property with 725 different owners. It will require moving 2,861,800 cubic yards of material at a cost of $3,577,050, from these properties, which have an area of 4,578,369 square feet. Assuming that the tax assessment is made on a basis of 50 per cent., this property is worth $8,818,020. It is estimated that the regrading will increase this valuation 75 per cent., or $3,000,000 more than its cost. Besides this cost for the work on private property there will be required excavation of 1,100,000 cubic yards of material from the city streets lowered at the same time, and $314,800 for reconstructing the public improvements affected, sewers, sidewalks, pavements, curb, parks, etc., or a total of $1,689,800, which is covered nearly twice by the profit in the increased valuation of the private property.

March, 1913.

MUNICIPAL LIGHTING PLANT OF TROY, OHIO.

By L. A. Pool, Superintendent.

THE evolution of electric lighting and power, which has been so marked during the last twelve years, with the wonderful changes and improvements in apparatus and methods, has been very distinctly demonstrated in the career of the Troy municipal electric light plant.

L. A. POOL.

The city of Troy was originally supplied with current for lighting and power by a private corporation known as the Troy Electric Light and Power Company, who were hampered in their service with the usual grade of inefficient and inadequate apparatus on the market at that time.

They had to contend with the old style equipment of small boilers, high speed engines and generators and, to a great extent, inexperienced labor, which, with a high rate of charge for current, naturally worked up an agitation for the city to have a plant of its own. This dissatisfaction on the part of the citizens finally culminated in the purchase of the franchise and equipment of the private company by the city in 1897, for which it paid $27,500.

The council immediately reduced the rates from 15 cents to 8 cents per kilowatt for metered current and from 85 cents to 40 cents per month for each 16 c. p. lamp.

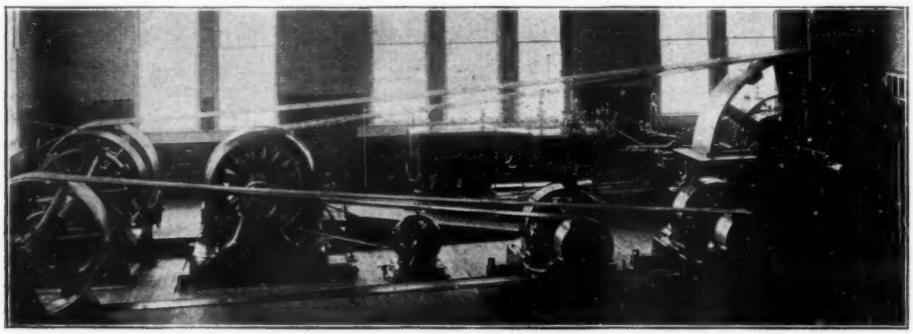
The plant, by hard struggling, increased in capacity and output each year under the management of competent boards of control until the years of 1903 and 1904, at which time a new board came into control of the plant, of whom a majority were opposed to the municipal ownership of anything and political disturbances ran rampant during the two years of their term of office. The possibilities of what the city could gain by operating its own plant, under present management, had been so thoroly demonstrated during the four years previous, they could not force the plant to a sale or discredit it, altho they carried the contention into the court in a general lawsuit.

This airing of municipal ownership in general and the city's electric plant in particular, was of great value to the citizens of Troy, who were shown the merits and demerits of the plant, and they have made it a point each election since to pick good, honest, practical business men to manage the city's affairs. With the above exception, Troy's municipal electric plant has been practically free from political influences and the management of the plant has had a free hand in the operation and management, making it possible to hold the same force of employes year after year.

Boiler Room

The boiler room contains an equipment of three Stirling water tube boilers, arranged in a single row and designed for 150 pounds steam pressure. The ratings of the boilers are: One class "E" of 200 h. p., one class "F" of 260 h. p., and a class "F" 300 h. p., which is equipped with a Roney mechanical stoker. This 300 h. p.

boiler has a heating surface of 2,932 square feet and a grate area of 62.7 square feet, with a steel stack of 60 inches diameter and a height of 120 feet above the floor level. A guarantee on this boiler was made to evaporate 10 pounds of water from and at 212 deg. F. per pound of dry coal, when the stoker is properly operated and fired with coal containing not less than 14,000 B.t.u. per pound.



TROY *municipal light plant, showing two Fort Wayne direct current generators, Fort Wayne alternating current belted generator and Fort Wayne exciter.*

The boilers are fed by two 7x4½x10 Platt Iron Works duplex boiler feed pumps, taking water from a 600-h. p. Cochran feed water heater.

A Stilwell-Bierce jet condenser of 600-h. p. capacity is connected to the exhaust piping from the engines, taking water thru a 6-inch pipe from the Miami and Erie canal just in the rear of the power house.

Engine Room

The engine room contains a direct connected and a belted engine set. The direct connected unit consists of a 16x34x36 Hamilton cross-compound heavy duty Corliss engine furnished by the Hooven-Owens-Rentschler Company and rated at 540 h. p. at 120 r. p. m. This engine was guaranteed in steam consumption at full load with 150 pounds gage initial pressure and exhausting into a 26-inch vacuum of 14.8 pounds per indicated h. p., 16.4 pounds per brake h. p. and 28.4 pounds per kilowatt at the switchboard. This engine is equipped with a gravity feed oiling system with nickel plated oil cups and trimmings, which gives the engine a very pleasing appearance. A Monarch automatic engine stop is installed on the engine for protection from excessive speeding of the engine.

The belted unit consists of a 400-h. p. Russell tandem compound engine, which was purchased in 1900. This engine is double belted to a 300-k. w. alternator and to a short line-shaft, the engine having an 11-foot flywheel and running at a speed of 140 r. p. m. This engine is of the slide valve type and is not very economical compared with the cross compound Corliss engine.

Electrical Equipment

Directly connected to the Hamilton cross compound engine is a 3-phase, 60-cycle, 1,150-volt generator, rated at 360 kva., furnished by the Ft. Wayne Electric Works. It is of the revolving field type, taking exciting current from a 20-k. w., 125-volt, 6-pole belted exciter running at 500 r. p. m., the exciter being belted direct from the engine shaft.

A 300-kva. generator of the same make and characteristics is belted to the 400-h. p. Russell engine, with a 7.5-k. w. exciter belted from the shaft of the generator.

From the line-shaft are belted two 75-k. w., 250-volt, direct current power generators, manufactured by the Hobart Electric Company, running at a speed of 700 r. p. m.

The 360-kva. direct connected generator will deliver 180 amperes of 3-phase current at 1,150 volts with a field excitation of 15 k. w. at 125 volts and the full load efficiency is 93 per cent. The exciter of

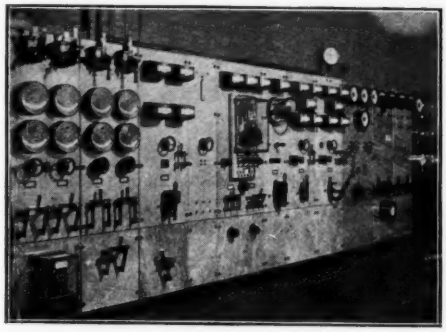
this set has a 4-k. w. capacity in excess of the amount of current required to excite the alternator at full load, operating at 80 per cent. power factor, which is used in exciting a synchronous motor in a motor generator set.

This motor generator set was furnished by the Ft. Wayne Electric Works and is made up of an 8-pole, 150-h. p., 1,150-volt, 3-phase, 60-cycle, revolving field synchronous motor mounted on a common cast iron sub-base and connected by a solid coupling on each end to a 6-pole, 50-k. w., 250-volt, compound-wound, direct-current generator.

This motor, running at 900 r. p. m., takes current thru an automatic oil switch and starting auto-transformer direct from the 1,150-volt bus-bars and the fields are designed for over-excitation for the correction of low power factors. This provision for the correction of the power factor is of great advantage to the plant, as the average power factor of the incandescent lighting system is 86 per cent., which drops to 78 per cent. when the arc lamps and motors are thrown on the line. By a very small expenditure of exciting current, the synchronous motor field can be over-excited and the power factor of the whole system brought back up to 100 per cent. or unity.

Switchboard

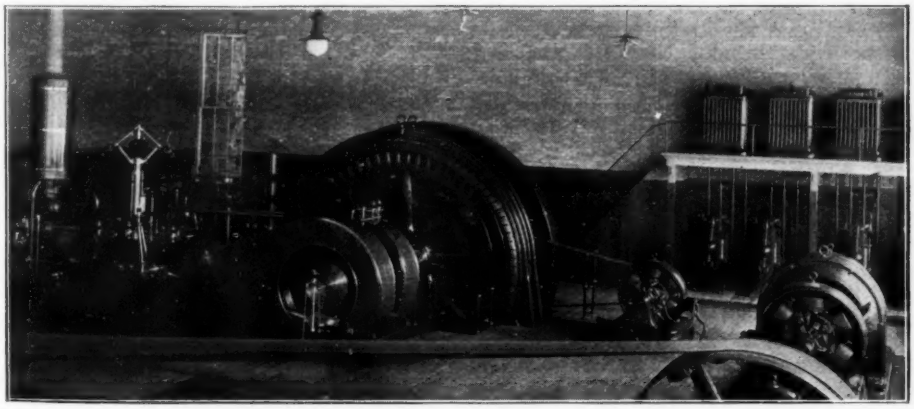
The switchboard is made up of 12 panels and one panel devoted to steam gages and recording instruments, the whole board being supported upon five concrete pillars, on the top of which is mounted an 8 by 10-inch timber, bolted to each pillar, making the switchboard independent of the floor and throughly insulated.



Controlling and distributing boards in Troy municipal electric light plant.

The switchboard was furnished by the Fort Wayne Electric Works and has the usual instruments for the proper control of the d. c. and a. c. generators and distribution system and in addition there are provided a Tirrell voltage regulator, frequency and power factor indicating meters, indicating and recording watt meters and automatic oil switches on the distributing lines. On the steam gage board are mounted a Bristol recording voltmeter and Crosby recording steam gage.

All wiring from the generators to the switchboard and from the board to the



TROY *municipal light plant, another view showing generator exciter and motor generator set.*

outside is with lead cables incased in fiber conduit buried under the cement floor of the basement.

Distribution

The electrical energy for lighting, which is distributed thruout the city at a potential of 1150 volts in six single phase feeders, is transformed thru 80 Fort Wayne transformers to 110 volts for lighting purposes.

Current is furnished at 220 volts, three-phase for power in large installation and 110 volts a. c. and 250 and 500 volts direct for small motors and elevators.

The plant has connected 1,525 h. p. of motors from which a large revenue is derived, 1,050 meters on lighting services, 66 meters on power services and 150 small contract consumers of light and power. The meters are practically all of Fort Wayne manufacture.

The city is lighted with 155 Western Electric 7.5 amp. series enclosed arc lamps, 34 series tungsten lamps (60 watt) and 90 lamps (16 c. p.) in the alleys, arches and public square lamp posts.

Rates

The rate for lighting current is 7½ cents per kilowatt for all purposes except for sign lighting, which is 5½ cents per kilowatt. Power is furnished for 4 cents for the first 100 k. w., 3 cents per k. w. for the next 300 k. w. and 2 cents for the next 2,000 k. w. The above rates are subject to a discount of 10 per cent. if payment is made before the 10th of each month. A rate of 40 cents per month for each 16 c. p. lamp is charged on contract. The minimum charge for current for meter is 66 cents per month and 50 cents per horse power per month for motors.

Financial Statement for 1912

The receipts from sale of lighting current for last year, 1912, were $25,228.00; from the current for power, $12,269.00, and for miscellaneous sources, $215.00, making a total amount of $37,712.00. Cash on hand January 1, 1912, $6,096.00.

The expenses for the year were for general administration, $3,168.00; manufacture, operation, $19,829.00; manufacture, maintenance, $2,700.00; distribution, maintenance, $2,037.00, making a total cost of operating $28,037.00.

The improvements put on the lines amounted to $3,800.00, cost of new meters installed, $1,183.00, and cost of new machinery in the plant amounted to $175.00, making a total cost of improvements of $5,158.00. Cash on hand January 1, 1913, $1,613.00.

The plant turned over to the city sinkfund trustees for the payment of bonds and interest on bonds $9,000.00. The plant did not receive any revenue for the lighting of the streets and city buildings of the city, during the past year.

All collections and disbursements are made and transacted in the office of the director of public service in the city building under the charge of the clerk, Mr. W. B. Freeman and Charles F. Runnells, city auditor.

The electric light and power plant is under the direct control of Mr. G. B. Hatfield, director of public service and the superintendent, L. A. Pool, who has his office at the power house.

A brief financial history of the Troy municipal light plant from the date of its purchase by the city, 1897, to the present time, 1912:

Bonds issued and paid by city.....	$61,500.00	
Interest on bonds paid by city.....	23,509.38	
Total expenditures by the city.....		$85,009.38
Bonds outstanding (not paid)		51,500.00
Bonds and interest paid to date		$33,509.38
Revenue paid over to the city sinking fund trustees by electric plant for payment of bonds and interest from 1897 to 1912		$33,962.00
Net balance in sinking fund for plant		$ 433.42

The above statement shows that the electric plant has paid all bonds that have fallen due and all the interest on

bonds as it became due and have a net balance in the sinking funds of $433.42 to be applied on next year's interest. No notice is taken of other receipts of the plant which have been sufficient to pay all running expenses and the depreciation has been taken care of, to a great extent, by the yearly improvements put on the plant and distribution system, leaving a cash balance to its credit, January 1, 1912, of $1,613.28.

The amount of electric current used for lighting of the streets and different departments of the city during the past year, 1912, for which the electric plant received no revenue, is as follows:

City Buildings:

Market house, council chamber, rest rooms, hall and clock tower	18,300 k. w.
Public service and auditor's office	2,173 k. w.
Total kilowatts used (all meter)	20,473 k. w.

Street lighting:

155 arc lamps and 34 series lamps (on meter)	155,690 k. w.
100 lamps in arches and alleys (estimated)	23,060 k. w.
Total kilowatts used for street lighting	249,750 k. w.
Total kilowatts used for all city lighting	270,223 k. w.

(The city used 17 per cent. of the total kilowatts generated.)

Cost of maintenance of street arc lamps for the year 1912, including labor of trimming, globes, carbon, lamp repair parts, etc., was $1,110.00.

Bonds Outstanding of Electric Plant:

$18,000@4½% interest, all due Jan. 1, 1918.
$28,000@4 % interest, first bond due Sept. 1, 1917.
$ 4,000@4 % interest, all due June 1, 1924.
$ 1,500@4 % interest, first bond due Sept. 1, 1925.

Total bonds outstanding, $51,500.
Amount of interest due each year, $2,150.

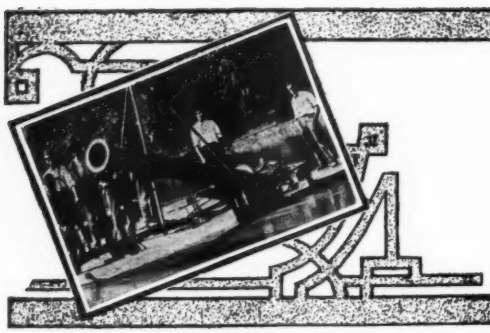
A SUBMERGED SEWER OUTLET

The Sanitary District of Chicago completed and placed in operation the North Shore Channel in the spring of 1911. In the construction of this channel thru Evanston several sewers were cut in two, and at that time the Sanitary District established a rule to have all sewer outfalls submerged if possible. Four screw pumps, each with a capacity of 250 c.f.s., pump the water from the lake into the channel, the lift being 3 feet. If two pumps only are being used the water in the channel will be between 0 and plus 3, and as the number of pumps in use varies, the elevation in the channel varies accordingly.

In 1912 a small system of combined sewers was laid in the northwest section of Evanston to drain a district just north of the North Shore Channel. The outfall was designed to have all dry weather and most of the storm water flow submerged. The grade of the 20-inch tile sewer above the drop manhole is 32 per cent., giving a capacity flowing fall of 9.5 c.f.s., using 0.011 for n in Kutter's formula. With the water in the channel at plus 3 the 12-inch submerged outfall has a capacity of 7.8 c.f.s., or the capacity of the 20-inch pipe flowing 0.7 full. In case of severe storms the upper 20-inch pipe will be required to take care of that part of the flow the 12-inch pipe cannot carry.

From experiments conducted with a weir in an old sewer, an automatic water level gage, and a tipping bucket rain gage, in the last half year it has been found that the peak of the run-off will not last over fifteen minutes in a sharp storm and not over thirty minutes in a very severe storm. With these data it is considered that the upper 20-inch outfall will seldom be brought into use and that time will be delayed until the district is well built up and paved so that the percentage of impervious territory will give a quick run-off in times of sharp storms.

The estimate for the outfall was $750 and was contracted for at that price. The contractor took advantage of times when all the pumps were shut down at the pumping station, and the water in the channel was at 0.0, to do most of his work. The pipes were surrounded with reinforced concrete as the banks of the canal have slipped in in a number of places along the canal, and it was feared that a slip might destroy the outfall. No difficulties were encountered in constructing the work and the contractor made a fair profit at the price bid.



EDITORIAL

WHAT IS A FAILURE IN MUNICIPAL OWNERSHIP?

A pamphlet was recently published by Public Service Publishing Company entitled "Two Hundred Municipal Ownership Failures," by Glenn Marston, which gives in the opening sentence of its introduction the difference between a municipal ownership failure and a business failure, both being on account of inability to meet expenses from the proceeds of operation of a public utility plant, the latter resulting in bankruptcy and the former in increased tax rate to meet the deficit. Financially, this may be correct, but practically, a municipally owned plant which does not pay its expenses may be a success from other points of view.

However, there would be no strong objection to this classification if it were adhered to, but the last sentence in the aforesaid introduction proposes to include in the list those municipal plants whose officials have failed to respond to requests for reports, on the ground that "it is a justifiable conclusion to believe that the plant is not sufficiently successful to make a report desirable." One might as well declare privately owned plants failures because they refuse to make reports.

Some such procedure was necessary to help round out the two hundred, but even counting Pittsburgh and Allegheny as the three entries made, the list is still not full.

But yet no serious complaint would be made of the list were it not filled with misinformation and misrepresentation, which is so flagrant that it need only be shown in enough cases to demonstrate its animus to destroy the entire effect of the publication. This is done elsewhere. Here it is only necessary to state briefly the nature of these misrepresentations by a few examples.

Towns absorbed by adjoining cities and therefore going out of business as separate corporations.

Investigations of other city departments in years past applied to new plants just starting.

Plants never owned by cities reported as sold by them.

Small generating plants discontinued because current can be purchased wholesale from larger plants for less money should be commended rather than listed as failures, as private plants would be.

Successful combined water and light plants are not municipal ownership failures because they do not keep the two accounts separate.

Controversies between "ins and outs" do not demonstrate failures of the plants when the figures show success.

Differences in bookkeeping methods have put several very successful Massachusetts plants into the list as well as some others, altho the books show the success, whatever system of keeping them is used.

Deficit the first year is hardly evidence of failure.

A failure of an automatic valve is hardly sufficient evidence of failure of municipal ownership. How many private plants are free from such failures? Or public plants?

The misrepresentations, or, to be as charitable as possible, the mistakes in getting information, are numerous and include such items as reporting city as closing power plant to purchase current of traction company when the reverse is the fact; reporting plants as burned, closed, leased to private parties, which events have not happened and plants are still in successful operation; increase in rates or high rates when decreases in rates and low rates are the real circumstances.

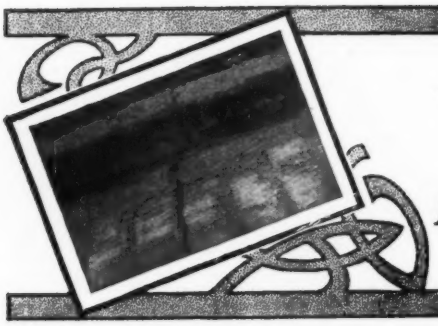
All these defects in the report and the list and many more have been demonstrated easily and are conclusive evidence of its utter unreliability. The fact that the author selected some of his information on the ground precludes the idea that all the misstatements are mistakes caused by ignorance of the true facts or dependence on rumors and reports from unauthorized sources.

Such publications by the advocates of private ownership are doubtless considered by their authors as dangerous attacks upon municipal ownership, but the shells are found to be empty and the firing of the gun is far more dangerous to the gunners than is the landing of the shot. Indeed, this shot is so badly timed that it exploded in air, and not even the bits of shell have landed.

The writer holds no brief for municipal ownership, but he does like to see good weapons used fairly, and will show up misrepresentation and falsehood when found in arguments on either side.

THE OUTLOOK FOR THE YEAR

The full reports of prospective work in the various lines of municipal improvement which appear in this number of MUNICIPAL ENGINEERING give evidence that the contractors for municipal work will be busy during 1913. Our American cities are rapidly passing their early periods of accumulation of wealth, when every effort is bent to the rapid growth of material projects. They are coming into the next period, when money is easier, when taxes are paid with less complaint or higher taxes are paid without more complaint, especially when good results are in evidence, when they show that the city is getting its money's worth.



MEN PROMINENT IN MUNICIPAL AFFAIRS

William W. Marr

Consulting engineer and member of firm of Aetna Engineering Bureau, Chicago, Ill., graduate Notre Dame University, 1896; entered the service of the city of Chicago in 1897 and acted in various capacities until 1903, when he became division engineer in charge of street pavements, which position he held until 1912, when he resigned to enter private practice.

As division engineer for the city of Chicago, Mr. Marr devoted considerable time to the study of street pavements and while acting as such made many improvements in methods of laying same. His most marked success was achieved while paving the "Loop," or business district of Chicago. Up to this time no satisfactory solution of paving along street car tracks had been brought to the attention of the municipal engineers in that city, with the result that no form of pavement had been made to stand up adjacent to street railway rails. After having been laid a short space of time, pavements showed signs of settlement. To correct these conditions, Mr. Marr investigated and found that previous to settlement sand appeared on the surface, showing that the sand cushion had moved from its original position; further investigation proved that the water from storms, sprinkling, etc., instead of draining into the catch basins, was remaining on the surface at the brow and gradually working its way beneath the paving blocks. This combined with street car traffic acted as a pump to force the sand from beneath one part of the pavement to another, the result being settlement along the car tracks. Having found the source of this trouble, Mr. Marr determined that the solution would be in perfect drainage between the car rail and the pavement. To secure this he arranged that the pavement should be laid not on a line level with the top of the rail nor above it, but on a line starting at the bottom of the bevel of the rail and dropping one inch or less within a space of twelve inches outside the rail, the result being a gradient sufficient to cause the water to drain. This system has been in use for the past three years and has today proven a success.

Member American Society of Civil Engineers and Illinois Society of Engineers and Surveyors.

C. D. Hill

Mr. C. D. Hill, engineer Board of Local Improvements, Chicago, Ill., graduate of University of Michigan, 1879, as civil engineer; 1879 to 1888, engaged on various engineering projects by the United States government and C. M. & St. P. R. R., the more important of which are the survey of the Hennepin Canal, the Chicago harbor, and railway construction in the west from 1882 to 1886.

In 1888, Mr. Hill entered the municipal field as assistant engineer, in charge of sewer and pavement construction for the village of Hyde Park, which later became part of Chicago. After annexation he was retained in the same position by the city of Chicago.

In 1893, Mr. Hill engaged in private practice and had charge of considerable work, being retained as a consulting engineer by many large contractors and corporations. In 1898, he became chief engineer of sewers of Chicago, and in 1901, this position was merged with the position of engineer of the Board of Local Improvements, which position he now holds.

As engineer of the board, Mr. Hill has been engaged during the past fifteen years in the designing and supervision of construction of sewers. The difficulties of this work are principally due to the limitations imposed by law, inasmuch as the cost of the work is assessed on property benefited and in no case can the assessment exceed the amount of the increase in the value of the land caused by the improvement. For that reason, it is not possible to build sewers in an outlying district that will be large enough when the district becomes densely populated.

In many portions of Chicago, where

Photo by Gibbon, Sykes & Fowler.

Cicero D. Hill, Engineer of Local Improvements, Chicago, Ill.

sewers were built twenty-five or more years ago, they are now inadequate and the conditions are rapidly becoming worse. In some of these districts, relief sewers have been built and in others plans are being prepared. It is difficult to show that all of the property which is served by the relief sewers is benefited, especially where cottages without basements have been built, and where the inadequacy of the sewers is apparent only in the deeper basements of the business houses, but the cottages may soon be replaced by the large, modern building, which could not be served properly by the existing sewers.

In the construction of these relief sewers, there are difficulties on account of the pavements to be replaced and because of interference with various underground pipe lines and conduits. These difficulties are met so far as is possible, by selecting streets where the pavements are worn out or by delaying the construction of the sewers, until the streets need to be repaved. Public utility corporations are required to care for and if necessary to remove their pipes and conduits, so that the property owners are put to no increased cost on that account.

The policy of building these sewers by special assessment has been quite satisfactory and the property owners are quite willing to pay their assesments after the sewer is built.

Since 1905, Mr. Hill has had charge of the design and construction of sewers as follows: 1905, 127,249 lin. ft. of sewers, ranging in diameter from 9 inches to 11 feet, constructed at a cost of approximately $595,000; 1906, 172,419 lin. ft. at a cost of approximately $842,000; 1907, 228,360 lin. ft. at a cost of $832,000; 1908,

Photo by Moffett, Chicago.

Herbert E. Hudson, Division Engineer Board of Local Improvements.

248,216 lin. ft. at a cost of $952,000; 1909, 292,239 lin. ft. at a cost of $1,090,000; 1910, 237,348 lin. ft. at a cost of $941,000; 1911, 259,556 lin. ft. at a cost of $545,000; 1912, 378,033 ft. at a cost of $683,000, not including sewers constructed by private contract.

Mr. Hill is a member of the American Society of Civil Engineers, Western Society of Engineers, Illinois Society of Engineers and Surveyors, Lake Michigan Water Commission and the Calumet Sewage Commission.

Herbert E. Hudson

In 1907, as a rodman, he was getting his experience in all branches of city work and laying a foundation for future work that would aptly fit him for the position he has now attained in the short space of four years.

By rapid rises, Mr. Hudson has, thru the civil service of Chicago, today reached the position of division engineer, with the improvement problems of large and exclusive residential suburban districts under his engineering guidance.

He attended Case School of Applied Science until 1907, when he entered the services of the city of Chicago as rodman. In 1908 he was promoted to the position of junior engineer of the Board of Local Improvements. In this capacity Mr. Hudson began to shoulder his greater responsibilities, principal of which was the construction of the intercepting sewers of the Lake View district in Belmont avenue and Wolfrom street. He was placed

Photo by Moffett, Chicago.

William J. Galligan, Assistant Superintendent of Streets. Chicago, Ill.

in charge of this work. It was of a highly exacting and difficult nature, requiring that all public service connections be maintained thruout the construction of the sewers.

He is at present in charge of the design and construction of the improvements carried on in the various north side suburbs, including Birchwood, Rogers Park, Edgewater, Jefferson, Ravenswood, Norwood Park, Edison Park, Forest Glen and Edgebrook, the population of which totals approximately 400,000.

During the year 1912, Mr. Hudson designed and supervised the construction of approximately twenty-six miles of brick and tile sewers, varying in diameter from twelve to seventy-two inches. He is a member of the Illinois Society of Engineers and Surveyors.

William J. Galligan

William J. Galligan, assistant superintendent of streets, Chicago, Ill., entered the municipal service in 1905, and promoted to his present position in 1912. Mr. Galligan, upon entering the service of the city was commissioned by the late Michael Dougherty, then superintendent of streets, to organize a bureau of compensation and to conduct it to the best interests of the city. That he was successful is shown by the collections turned in by this bureau, while in his charge. Among other innovations introduced by Mr. Galligan while here, were the first collections of compensation due the city for sub-sidewalk space overhanging bay windows, switch tracks on city property, streets, stub ends and various other special privileges for which the city received no compensation.

In October, 1906, Mr. Galligan was appointed superintendent of the Thirty-third ward and later assigned permanently to the Eighth ward, which is made up of the suburbs of South Chicago, the site of the Illinois Steel Company's south works, Hegewisch, the site of many manufacturing plants; Cheltenham, Windsor Park, Bryn Mawr and Park Manor, the last four being high-class residence districts along the south shore of Lake Michigan.

This district comprises approximately thirty-two square miles, with 250 miles of unpaved streets and a population of 63,000, made up principally of foreigners from southern Europe, who cannot understand the needs of cleanliness when applied to streets and alleys.

While acting as ward superintendent, Mr. Galligan introduced the system of whitewashing the alley fences and houses facing on alleys. This system is now practiced in all congested districts of Chicago, and has been taken up by other cities where conditions warrant the adoption of such measures.

As second superintendent of streets, Mr. Galligan has immediate charge of all street and alley cleaning, collection of garbage and refuse, and supervision over the ward superintendents and their forces in this branch of the service.

Owing to the numerous perplexing situations connected with the cleaning of the second largest city in the United States and perhaps one of the largest in the world, when the area is considered, one can readily surmise the extent of his responsibility.

Specific duties assigned to the position are as follows: Inspection of the condition of each ward, at least once every ten days; investigation of methods, machinery, etc., in use in other cities and reports as to the advisability of their adoption in Chicago; preparation of specifications, recommendations as to contemplated purchases of machinery, tools, materials, etc., used on the work under his supervision and reports at stated intervals, proposed means of procuring greater efficiency or reducing cost of the work.

Municipal Improvements for 1913.

What the Cities of the United States Expect to Construct during 1913.

Cities whose programs of improvement have not yet been adopted and those not now contemplating improvements in 1913 are omitted.

PAVEMENTS TO BE CONSTRUCTED IN 1913.

ALABAMA.

Dothan: Indefinite.
Gadsden: Asphalt concrete, 20,000 sq. yds.
Macadam, 40,000 sq. yds.; city does this.

ARIZONA.

Phoenix: $300,000 to be expended.

ARKANSAS.

Paragould: Concrete, 45,000 sq. yds.

CALIFORNIA.

Alhambra: Bituminous macadam, 2 miles.
Burlingame: $200,000 worth now in progress.
Coalinga: More than $125,000 expenditure probable.
Colton: Asphalt, 140,000 sq. ft.
Fresno: $100,000 to be expended.
Gilroy: Asphalt, 4,179 linear ft.
Glendale: $250,000 worth in progress.
Huntington Beach: Bituminous macadam, 2 miles 20 ft. wide.
Oiled surface, 1 mile 20 ft. wide.
Petrolithic, half mile.
Imperial: Concrete, 44,420 sq. yds.
Inglewood: Oil macadam, 170,250 sq. yds.
Lodi: Asphalt, 132000 sq. yds.
Concrete, 132,000 sq. yds.
Long Beach: Concrete, several miles.
Los Angeles: Asphalt, 25 miles.
Bituminous macadam, 5 miles.
Brick, 2 miles.
Concrete alleys, 1 mile.
Monterey: In contemplation for early work.
Oakland: Permanent pavement, 5 miles.
Oil macadam (including grading and curbing), 19 miles.
Oroville: Bitulithic, 9,900 ft., 42 ft. wide.
Palo Alto : Asphalt, 10,000 sq. yds.
Pasadena: Asphalt, 37,760 sq. yds.
Bituminous macadam, 1.44 mi.
Brick, 1,650 sq. yds.
Oiling, 5 mi. of 1 in. and 2 in.
Asphalt concrete, 3.5 mi.
San Bernardino: $150,000 to be expended.
Santa Barbara: Roads, $29,000.
Sonoma: Several blocks probable.
Vallejo: Bitulithic, 50,000 sq. yds.
Bituminous macadam, 50,000 sq. yds.
Visalia: $50,000 to be expended.
Willits: Asphalt, 21,000 sq. yds.
Concrete, 2,000 ft.

COLORADO.

Fort Collins: $6,300 to be expended.
Grand Junction: $50,000 to be expended.

CONNECTICUT.

Ansonia: Bituminous macadam, 1,500 sq. yds.
Granite, 5,000 sq. yds.
Wood, 3,500 sq. yds.
Derby: 4,000 sq. yds.
Hartford: 50,000 sq. yds.
Middletown: Bitulithic, 28,000 sq. yds. soon.
Macadam, to be done only by city.
Southington: Work for this year not planned; large amount done last year.
Torrington: Bituminous macadam, 4,000 ft.
Macadam, 2,000 ft.
Other pavement, 1,000 ft.
Wallingford: Bithulithic, 8,500 sq. yds.
Bituminous macadam, 5,000 sq. yds.
Brick, 8,500 sq. yds.
Wood, 4,250 sq. yds.
Hassam or Warrenite, 8,000 sq. yds.

DISTRICT OF COLUMBIA.

Washington: Asphalt and bituminous macadam.
Resurfacing, $365,000.
New work, $200,000.

FLORIDA.

Dade City: Macadam, 6 miles.
Sarasota: $45,000 proposed.

GEORGIA.

Americus: 2,000 sq. yds.
Athens: An election will be held on March 25 to issue $75,000 bonds for street improvements.
Augusta: Plans not completed.
LaGrange: Brick, 2,000 sq. yds.

IDAHO.

Boise City: $150,000 to be expended.
Weiser: Bitulithic, 30536 sq. yds.

ILLINOIS.

Alton: Brick, 3 miles.
Assumption: Brick, 6,500 sq. yds. let; 15,000 sq. yds. not let.
Bloomington: Brick, 57,514 sq. yds.
Canton: Brick, 35 miles.
Carlinville: Concrete, 5,000 sq. yds.
Chicago Heights: Bituminous macadam, 10,000 sq. yds.
Brick, 50,000 sq. yds.
DeKalb: Brick; will make plans, etc., for four streets to go in in 1913 or 1914.
Dixon: Asphalt, 7,400 sq. yds. contemplated, not decided.
Brick, 100,000 sq. yds.
Concrete, 2,400 sq. yds. contemplated and probable.
Macadam, 26,000 sq. yds.
East St. Louis: Brick, 240,110 sq. yds.
Edwardsville: Brick, 2,000 yds.
Concrete, 1,200 yds.
Elgin: Bituminous macadam, 50,000 sq. yds.
Brick, 34,373 sq. yds.
Asphaltic concrete, 11,355 sq. yds.
Galesburg: Brick, 66,861 sq. yds.
Granite City: Wood, 12,000 sq. yds.
Greenville: $10,000 estimated.
Lake Forest: Bituminous macadam, about 30,000 sq. yds. proposed.
Mattoon: Brick, 40,000 sq. yds.
Maywood: Brick, about 50,000 sq. yds.

Moline: Brick, 50,000 sq. yds.
Concrete, 20,000 sq. yds.
Wood, 30,000 sq. yds.
Newton: Concrete, 6,980 sq. yds.
Normal: Brick, 20,000 sq. yds.
Oak Park: Asphalt, 2.60 miles or 64,800 sq. yds.
Bituminous macadam, 8.90 miles, or 161,600 sq. yds.
Brick, 3 miles, or 34,000 sq. yds.
Olney: Brick; can not tell yet.
Macadam; not fully settled yet.
Ottawa: Brick, 66,000 and 123,000 sq. yds.
Pekin: Brick, 41,000 sq. yds.
Pontiac: Brick, 10,000 sq. yds.
Quincy: Bituminous macadam, 30,368 sq. yds.
Brick, 13,297 sq. yds.
Creosoted wood, 15,741 sq. yds.
Rockford: Brick, 50,000 sq. yds.
Macadam, 15,000 sq. yds.
Rock Island: $200,000 will be expended.
Streator: Brick, 9,000 sq. yds.
Waukegan: Brick, 29,000 sq. yds.
Wood, creosote, 3,500 sq. yds.
Cedar blocks, 900 sq. yds.
Asphaltic concrete, 8,600 sq. yds.
Sandstone blocks, 1,850 sq. yds.
Wood River: Bituminous macadam, 15,000 sq. yds.

INDIANA.

Bloomington: Brick, 25,000 sq. yds.
Macadam, 5,000 sq. yds.
Connersville: Concrete, 35,000 sq. yds. by city, 6,000 sq. yds. by county.
Macadam, 2¼ mi. stone, 14 to 20 ft. wide; 3½ mi. gravel, 14 ft. wide; by county.
Covington: Macadam, 9,000 sq. yds.
Crawfordsville: Brick, 42,485 sq. yds.
Concrete, 7,940 sq. yds.
Fort Wayne: Asphalt, 3.5 miles.
Bituminous macadam, 0.5 miles.
Brick, 3.0 miles.
Gary: Bituminous macadam, 9,000 sq. miles.
Brick, 30,000 sq. yds.
Macadam, 62,000 sq. yds.
Hartford City: Brick, 30,000 yds.
Concrete, 30,000 yds.
Huntington: No prospects for pavement this year.
Lafayette: Brick, 379 sq. yds. alley paving.
North Vernon: Brick, 3,000 yards.
Macadam, some.
Plymouth: $30,000.
Portland: 15,000 sq. yds.
Richmond: Brick, 16,200 sq. yds.
Concrete, 3,000 sq. yds.
Macadam, 4,000 sq. yds.
Gravel, 2,000 sq. yds.
Terre Haute: 47,757.67 sq. yds.
Burlington: Brick, 1,500 sq. yds.
Concrete, 32,500 sq. yds.
Cedar Falls: Not known until May.
Cedar Rapids: Asphalt to resurface, 50,000 yds. (now let).
Brick, 4-inch concrete base, 45,000 yds.
Concrete, 6,500 yds.
Clinton: Brick, 100,000 sq. yds.
Concrete, 28,000 sq. yds.
Corning: Brick, 24,000 yds.
Concrete, 1,000 yds.
Dubuque: Bituminous macadam, 10,000 sq. yds.
Brick, 30,000 sq. yds.
Macadam, 30,000 sq. yds.
Wood, 30,000 sq. yds.
Eagle Grove: Asphalt, bitulithic or bituminous macadam, 30,000 sq. yds.
Fort Madison: Brick, 22,500 sq. yds.
Hamburg: Bituminous concrete, 30,000 sq. yds.
Independence: Asphalt concrete, 14 blocks.
Indianola: $12,000.
Marion: (Complete change of officers last Monday in March; nothing doing now.)
Marshalltown: $48,000 worth.
Muscatine: $25,000 worth.
Newton: Concrete, 55,000 yds.
Oskaloosa: Brick, possibly 10 to 20 blocks.
Red Oak, (Will have new council last of March and nothing doing now.)
Webster City: Either asphalt, bitulithic or bituminous, 20,000 sq. yds.

KANSAS.

Arkansas City: Asphalt, 12 blocks; bids open March 3.
Bituminous macadam, 12 blocks.
Chanute: Brick or concrete, 6,000 sq. yds.
El Dorado: Brick; not certain, but possibly 6,000 yds.
Emporia: Bituminous concrete or brick, 20,000 sq. yds. or more. (Contract in March.)
Fort Scott: $20,000 worth.
Girard: Asphalt, 1,400 sq. yds.
Brick, 300 sq. yds.
Manhattan: 30,000 sq. yds.
McPherson: Brick or asphaltic concrete, about 25,000 sq. yds.
Newton: Either bitulithic or brick, 50,000 sq. yds.
Osawatomie: Will spend about $20,000.
Ottawa: Bituminous macadam, 6,500 sq. yds.
Brick, 5,000 sq. yds.
Paola: Brick, 7,000 yds.
Concrete, 3,000 yds.
Pittsburg: Brick, 60,000 sq. yds.
Concrete (under consideration).
Saline: Asphalt, one-half mile.
Brick, one-half mile.
Topeka: Prospects for $100,000 expenditure.
Wichita: Asphalt, ½ mile.
Bituminous macadam, 1½ miles.
Brick, 1 mile.
Concrete, ¼ mile.

KENTUCKY.

Dayton: $30,000 worth.
Louisville: Will spend $750,000 in new pavements, lettings in March and April.
Ludlow: $20,000 worth.
Owensboro: 7,000 sq. yds.
Pikeville: Brick, 27,000 sq. yds.

LOUISIANA.

Baton Rouge: Are talking of issuing bonds for gravel roads, etc., but nothing definite.
New Orleans: Asphalt, 63,400 sq. yds.
Bitulithic, 5,500 sq. yds.
Mineral rubber, 19,500 sq. yds.
Creosoted wood block, 3,200 sq. yds.
Granite, 700 sq. yds.

MAINE.

Lewiston: Bituminous macadam, about 5,000 sq. yds.
Pittsfield: 5,000 sq. yds.
Rockland: Bituminous macadam, 5,000 sq. yds.

MARYLAND.

Baltimore: Will spend $1,000,000 to $1,500,000.

MASSACHUSETTS.

Cambridge: (Plans and estimates not yet made.)
Fitchburg: Macadam, 20,000 sq. yds.
One mile of street construction.
Great Barrington: (Not yet determined.)
Lawrence: Granite, 20,750 sq. yds.
Lowell: $75,000 worth.
Medford: (Not determined; use no contract labor.)
New Bedford: Nothing definite decided upon.
Southbridge: Either bitulithic or bituminous macadam, 15,000 sq. yds.

March, 1913.

Brick, 8,700 sq. yds.
Drainage and subgrade, 3 miles long.
Webster: (Not yet determined.)
Westfield: Asphalt, 20,000 sq. yds.
Macadam, 25,000 sq. yds.

MICHIGAN.

Alpena: Concrete, about 10,000 sq. yds. (nothing definite until May 1).
Cadillac: 8,000 sq. yds.
Escanaba: 14,000 sq. yds.

Detroit:

Resurfacing 24 streets with brick	$295,800.00
Patching brick pavements.	60,000.00
Patching and repairing cedar block pavements..	50,000.00
Resurfacing 12 streets with granite block	273,660.00
Patching granite block pavements	5,000.00
Stone pavements and alley crossings	15,000.00
Foundations of 21 streets under tracks	387,050.00
Resurfacing and repairing pavements under and along tracks, Detroit Ry.	25,000.00
Repaving, dressing stone and other expenses	7,000.00
Repaving 9 streets with asphalt	90,220.00
Repaving 6 streets with brick	32,030.00
Repaving 2 streets with creosoted block	17,910.00
Resurfacing 35 streets with creosoted block	929,500.00
Patching creosoted block pavements	500.00
Resurfacing 39 street with asphalt, brick, cedar, creosote block, granite block and stone pavements, and estimate for asphalt is	406,122.00
For patching sheet asphalt pavements	25,000.00
Total	$2,619,792.00

Grand Rapids: $100,000 to $200,000 will be spent.
Greenville: (Nothing in sight.)
Hastings: Concrete, 16 blocks, 28-foot roadway; letting of contract, March 28.
Highland Park: 35,000 to 50,000 sq. yds.; material determined when contracts let.
Hillsdale: Asphaltic concrete, 20,000 sq. yds.
Brick, 6,000 sq. yds.
Macadam, 12,000 sq. yds.
Port Huron: Bituminous macadam, 15,000 sq. yds.; resurfacing.
Saginaw: Asphalt, 30,000 yds.
Brick, in gutters only.
Macadam, 5,000 yds.

MINNESOTA.

Bemidji: 7,000 sq. yds.
Faribault: Wood, 11,600.
Mankato: Bituminous macadam, 1 mile.
Gravel, ½ mile.
Minneapolis: Bituminous macadam, 50,000 sq yds.
Brick, 20,000 sq. yds.
Concrete, 20,000 sq. yds.
Wood creosoted, 150,000 sq. yds.
Sandstone, 10,000 sq. yds.
St. Paul: New pavements, $800,000.
Stillwater: Brick, possibly 2 blocks.
Concrete, possibly 5 blocks.
Macadam, few blocks possible.
Winona: Brick, 4,970.
Wood, 12,500.

MISSISSIPPI.

Clarksdale: Either asphalt, bitulithic, brick, concrete or wood, 15,000 sq. yds.
Hattiesburg: Brick, 1,000 sq. yds.
Macadam, 5 miles to be built by county within city limits.
Vicksburg: 8,200 feet.

MISSOURI.

Columbia: Concrete, 17,883 sq. yds.
Fulton: Brick, 1,500 sq. yds.; contract let
Concrete, 3,400 sq. yds.
Hannibal: Bitulithic, 40,000 sq. yds.
Bituminous macadam, 25,000 sq. yds.
Brick, 16,000 sq. yds.
Concrete, 30,000 sq. yds.
Independence: Work will not be outlined until after April 15.
Jefferson City: Bituminous macadam (penetration), 3 miles.
Brick, 0.2 miles.
Kansas City: Asphalt, 130,000 sq. yds.
Bituminous macadam, 15,000 sq. yds.
Brick, 75,000 sq. yds.
Concrete, 200,000 sq. yds.
Stone block, 25,000 sq. yds.
Wood, 10,000 sq. yds.
Kirksville: Asphalt, 15,000 sq. yds.
Brick, 6,000 sq. yds.
Concrete, 12,000 sq. yds.
Other pavements, 5,400 sq. yds.
Liberty: Concrete, 40,000 sq. yds.
Nevada: Concrete, 10,000 sq. yds.
Poplar Bluff: Brick, 2 miles.
Sedalia: Bituminous macadam, 10,000 sq. yds. contemplated.
Brick, 30,000 sq. yds.
Concrete, 5,000 sq. yds. contemplated.
Springfield: Asphalt, 50,000 sq. yds.
Concrete, 100,000 sq. yds.
Wood, 2,040 sq. yds.
Webb City, Bituminous macadam, 1 mile.

MONTANA.

Bozeman: Will spend $100,000.
Great Falls: Bitulithic, 50,000 sq. yds.
Helena: Brick, 15,000 sq. yds.
Macadam, 10,000 sq. yds.
Lewistown: (List will not be completed before March 1.)

NEBRASKA.

Falls City: Brick, 25,000 sq. yds.
Lincoln: Asphalt, about 45,000 sq. yds.
Brick, about 45,000 sq. yds.
Norfolk: Bituminous Concrete, 45,000 sq. yds.
Macadam, 5,000 sq. yds.
University Place: Brick, 8 blocks.

NEVADA.

Reno: Bituminous macadam, 2 miles.

NEW HAMPSHIRE.

Laconia: $10,000 worth.
Littleton: Macadam, 2,600 feet in length.

NEW JERSEY.

Bayonne: $175,000 worth in contemplation.
Dover: Macadam and grading by town.
Elizabeth: Five miles.
Jersey City: Asphalt street repair, $12,500.
Macadam maintenance, $10,000.
Long Branch: Bitulithic, 68,000 sq. yds.
Brick, 60,000 sq. yds.
Newark: Asphalt, 1 mile, or 21,000 sq. yds.
Bitulithic, 1½ miles, or 32,000 sq. yds.
Brick, 2 miles, or 45,000 sq. yds.
Granite, 6 miles, or 127,000 sq. yds.
Asphalt blocks, 1 mile, or 21,000 sq. yds.
Ocean City: Brick, 5,000 sq. yds.
Concrete, 10,000 sq. yds.
Wood, 10,000 sq. yds.
Gravel, 10,000 sq. yds.
Plainfield: Bituminous macadam, possibly small amount.

Brick, possibly small amount.
Concrete, possibly small amount.
Macadam, 2 miles.
Wood, some street railway intersections.

Ridgewood: Brick, 3,300 sq. yds.
Macadam, 29,000 sq. yds.

Rutherford, Boro. of: Brick, 1.25 miles, 32,000 sq. yds.
Macadam, 1 mile.
Tarvia, 1 mile.

South Orange: Bituminous macadam, 2 miles.
Macadam, 3 miles.

Trenton: Asphalt, 10,000 sq. yds.
Bituminous concrete, 70,000 sq. yds., "Topeka Spec."
Brick, 8,700 sq. yds.
Concrete, 5,700 sq. yds.
Granite, 2,000 (with old blocks).

Westfield: Concrete, 20,000 sq. yds.
Macadam, 25,000 sq. yds.

West New York: Asphalt block, 8,000 sq. yds.
Bitulithic, 6,000 sq. yds.
Brick, 8,000 sq. yds.
Trap rock blocks, 12,000 sq. yds.

NEW MEXICO.

Albuquerque: Expects to contract about $75,000 of pavements.

NEW YORK.

Binghamton: Bitulithic, 12,000 sq. yds.
Brick, 9,000 sq. yds.
Concrete, 7,000 sq. yds.

Carthage: $18,000.

Catskill: From 1,300 to 1,400 feet of the State Highway, which passes through Catskill, may possibly be paved.

Cortland: Bituminous macadam, 1,400x20 ft.; 1,500x60 ft.
Concrete, 1,400x9 ft.

Elmira: Asphalt, 2,000 sq. yds.
Brick, 28,000 sq. yds.

Hudson: $35,000.

Ilion: Bitulithic, 25,000 sq. yds.

Jamestown: Three miles.

Manhattan, Boro of, New York City: (Question of improvements not yet settled).

Niagara Falls: About 60,000 sq. yds. (material decided after bids are received.)

Norwich: None.

Ogdensburg: Brick paving, 63,500 sq. yds. contract let.

Rensselaer: Brick, 1½ miles.
Macadam, ½ mile.

Rye: Asphalt block, 4,750 sq. yds.
Bituminous macadam, 56,000 sq. yds.

Schenectady: Asphalt, 80,000 sq. yds.
Bituminous macadam, 4,000 sq. yds.
Brick, 6,000 sq. yds.

Syracuse: Asphalt, 3 miles.
Brick, 2.13 miles.
Macadam, 1.12 miles.

Troy: Asphalt, 10,000 to 60,000; type not decided upon.
Bitulithic, 60,000; type not decided upon.
Bituminous macadam, 27,000.
Brick, 35,000.
Concrete, 60,000; type not decided upon.
Granite relaid, 100,000.

Watertown: Bitulithic, 1 mile.
Bituminous macadam, 1 mile.
Brick, 1 mile.
Concrete, ½ mile.
Macadam, 2 miles.
Wood, 1-3 mile; contract let.

NORTH CAROLINA.

Greensboro: Bituminous macadam, 2,000 ft.
Concrete dolarway, 4,000 ft.

Lumberton: Bituminous macadam, 10,000 sq. yds.

Raleigh: Will vote in early spring on $500,000 bond issue for street paving.

Rocky Mount: About $50,000 estimated; kind not decided.

Wilmington: Clay gravel, 8,000 sq. yds.

Wilson: $80,000.

NORTH DAKOTA.

Minot: Will receive bids on 19,232 sq. yds. of bitulithic, brick, concrete, creosoted block and sandstone; kind to be determined at time of letting.

OHIO.

Barberton: Brick, 10,963 sq. yds.

Bowling Green: Bituminous macadam, 2,500 sq. yds.

Bryan: Contract let for 25,200 sq. yds. paving with Metropolitan block, 6-inch concrete foundation, cement curb and gutter.

Cambridge: Brick, 22,500 sq. yds. on 4-inch concrete base.

Canton: Brick, 6 miles.

Carrollton: Brick, 1,500 sq. yds.

Conneaut: Brick, 2,200 lineal ft.

Delaware: 18,000 sq. yds.

Fostoria: Asphalt block or brick, 33,000 sq. yds.

Lorain: 40,000 sq. yds. paving; bids to be asked for on asphalt, bitulithic, bituminous macadam and brick.

Mansfield: $66,000.

Massillon: Brick, 28,000 sq. yds.
Concrete, 900 sq. yds.
Macadam, 20,000 sq. yds.
Gravel, 15,000 sq. yds.
Bituminous macadam, probably.

Miamisburg: 15,000 sq. yds.

Newark: Brick, 51,961 sq. yds.

Niles: Brick, 50,000 sq. yds.

Paulding: Brick, 2,500 sq. yds.

Pomeroy: Brick or concrete, 22000 sq. yds. County is planning to build about five miles of brick road or concrete road with asphalt wearing surface.

Ravenna: Brick, 10,210 sq. yds.

Salem: Brick, 358 ft., 16 ft. alley.

Springfield: 205,460 sq. yds.; specifications open to asphalt, bitulithic, brick and wood.

Steubenville: Brick, 40,000 sq. yds.

Tiffin: Brick, 14,800 sq. yds.
Concrete, 2,615 sq. yds.
Macadam, 1 mile long, 14 ft. wide.
The brick paving is to have sandstone curb, and the concrete paving to have concrete curb.

Warren: $60,000.

Wellsville: Brick, 10,000 sq. yds.

Wooster: Brick, 39,665 sq. yds.

Zanesville: Brick, 72,000 sq. yds.

OKLAHOMA.

Durant: $75,000.

McAlester: Concrete, 800 ft.

Okmulgee: Will probably spend about $100,000.

Tulsa: Five miles.

OREGON.

Coquille: Bituminous macadam, 13,000 sq. yds.
Concrete, 4,000 sq. yds.
Wood, 2,200 sq. yds.

Eugene: Asphalt and bitulithic or bituminous macadam, 101,500 sq. yds.; probably about half of each.
Bitucrete, 3,500 sq. yds.
Macadam, 4,000 lin. ft.

Grant's Pass: 35,000 sq. yds.

McMinnsville: 3 to 4 miles.

PENNSYLVANIA.

Athens: Macadam, about 1,200 ft.

Catasauqua: Bituminous macadam, 8,000 sq. yds.

Dravosburg: Brick, 10,000 sq yds.

DuBois: Brick, 8,000 sq. yds.

Erie: Asphalt, 7,500 ft., 86,500 yds.
Brick, 3,000 ft., 10,000 yds.

Farrell: Brick, 30,000 sq. yds.
Franklin: 15,000 sq. yds.
Hanover: Asphalt, brick or wood, about 48,000 sq. yds.; material not determined; will ask for bids on each kind.
Harrisburg: Asphalt, 66,624 sq. yds.
Hollidaysburg: 8,000 sq. yds.
McKeesport: $52,000.
McKees' Rocks: Brick, 6,000 sq. yds.
Granite, 6,000 sq. yds.
Meadville: One mile.
Monongahela: Brick, 7,600 sq. yds.
New Brighton: Brick, 8,000 sq. yds.
Norristown: $13,000 worth.
Ridgway: Brick, 11,000 sq. yds.
Sayre: Brick, 1,200 ft. or 4,800 sq. yds.
Sharpsville: Brick, 10,000 sq. yds.
Swissvale: Brick, 1.4 miles, 23,000 sq. yds.
Wilkesbarre: Contemplates expenditure of $75,000.
York: Asphalt, bitulithic or brick, 20 miles.

RHODE ISLAND.

Cranston: $40,000.
East Providence: Bituminous macadam, 4,400 linear feet.
Macadam, only considerable resurfacing.
Newport: (Appropriations not yet made.)
Pawtucket: (No work yet outlined.)
Woonsocket: Granite, 3,500 sq. yds.

SOUTH CAROLINA.

Charleston: $90,000 of street work proposed.
Columbia: Asphalt, contract awarded for 4,500 ft. of 50-foot street.
Brick, 1,500 ft. of 40-foot street.

SOUTH DAKOTA.

Aberdeen: One mile.
Sioux Falls: Concrete, 40,000 yds.

TENNESSEE.

Columbia: Macadam, 29,000 sq. yds.
Memphis: Asphalt, 50,000 sq. yds.
Bituminous macadam, 10,000 sq. yds.
Brick, 5,000 sq. yds.
Concrete, 2,000 sq. yds.
Wood, 40,000 sq. yds.
Gravel, 10,000 sq. yds.

TEXAS.

Brownsville: One mile.
El Paso: Will spend $250,000 or more on pavements.
Lufkin: (Some talk of street improvements and public roads, but nothing definite.)
Paris: Asphalt, 40,000 sq. yds.
Brick, 4,000 sq. yds.
Macadam, 7,000 sq. yds.
Waxahachie: Brick, 1 mile.
Macadam, 1½ miles.
Wood, 8,000 sq. yds.
Hassam, 6,000 sq. yds.

UTAH.

Ogden: Asphalt, 22,106 sq. yds.
Concrete, 1,700 ft. 20 ft. wide.
Salt Lake City: Asphalt, 5.8 miles.
Concrete, 0.3 miles.

VERMONT.

Barre: Granite, 7,000 sq. yds.
Bellows Falls: Macadam, ½ mile.

VIRGINIA.

Newport News: Bituminous macadam, 10,000 sq. yds.
Brick, only repairs.
Broken stone and gravel, 7,000 sq. yds.

WASHINGTON.

Aberdeen: Asphalt, 70,000 sq yds.
Concrete, 3,500 sq. yds.
Wood, 2 mi., 16 or 20 ft. wide.
Hoquiam: Asphaltic concrete, 35,000 sq. yds.
Bitulithic, 15,000 sq. yds.
Above in prospect. Contracts already awarded for equal amount.
Pullman: Asphalt, bitulithic and bituminous macadam, 17,000.
Oiled macadam, possible trial.
Seattle: Asphalt paving, 150,000 sq. yds.
Brick, 75,000 sq. yds.
Sandstone, 16,500 sq. yds.
Wood, 7,500,000 ft. B. M.
Tacoma: Pavements, $400,000.
Walla Walla: About 30,000 sq. yds., kind not yet determined.

WEST VIRGINIA.

Parkersburg: Brick, 90,000 sq. yds.
Concrete, 40,000 sq. yds.

WISCONSIN.

Baraboo: One mile.
Baraboo: One miles.
Burlington: Macadam, 10,000 sq. yds.
Chippewa Falls: $10,000.
Delavan: Brick, 8,912 sq. yds.
Eau Claire: Bituminous macadam, 3,000 sq. yds.
Brick, 1,000 sq. yds.
Macadam, considerable; no exact figures.
Wood, 2,000 sq. yds. on bridge.
Fort Atkinson: Two miles.
Kenosha: 15 miles.
Madison: Bituminous macadam, 85,000 sq. yds.
Marinette: Macadam, 20,000 sq. yds.
Oshkosh: Sarco, 4,300 sq. yds.
Tar macadam, 7,260 sq. yds.
Brick, 2,100 cement filler.
Concrete, 30,000 reinforced.
Macadam, 4,000 sq. yds.
$21,000 appropriated for improvement of streets by paving or otherwise; also $3,000 for crushed stone and gravel for repairs of streets.
Portage: Bituminous macadam, 30,000 sq. yds.
Port Washington: 22,000 sq. yds.; material not determined.
Sheboygan: Brick, 23,900 sq. yds.
Concrete, 46,820 sq. yds.
Macadam, 9,000 sq. yds.
Wood, 1,550 sq. yds.
Other, 12,400 sq. yds.
South Milwaukee: Concrete, 15,000 sq. yds.
Two Rivers: $22,000.
Waukesha: Bituminous macadam, 40,000 sq. yds.
Waupaca: Concrete, 1,000 sq. yds.
Macadam, 6,400 sq. yds.

CANADA.

Chatham, Ontario: Bitulithic, 2,800 yds.
Guelph, Ontario: Concrete, 9,000 sq. yds.
Tar macadam on concrete base, 13,890
Hamilton, Ontario: Asphalt, 75,000 sq. yds.
Bituminous macadam, 20,000 sq. yds.
Concrete, 3,000 sq. yds.
Macadam, 85,000 sq. yds.
Wood, 12,000 sq. yds.
Lethbridge, Alberta: Asphalt and bitulithic, 14,000 sq. yds.
London, Ontario: Asphalt, 3,000 ft.
Bitulithic, 3,500 ft.
Brick, 2,000 ft.
Concrete, 5,300 ft.
Ottawa, Ontario: Asphalt, 4 miles.
Prince Rupert, B. C.: Plank roads, $45,000.
Regina, Sask.: Wood, asphalt and bitulithic; total, 170,000 sq. yds..
Vancouver, B. C.: Not yet outlined.

NOVA SCOTIA.

Halifax: Bituminous macadam, 5,000 yds.
Macadam, 10,000 yds.

SIDEWALKS TO BE CONSTRUCTED IN 1913

ALABAMA.

Dothan: Indefinite.
Gadsden: Cement, 2 miles.
Jasper: Cement, 1 mile.

ARIZONA.

Nogales: A little.
Phoenix: 25 miles.

ARKANSAS.

Paragould: Cement, 1,000 sq. yds.

CALIFORNIA.

Alhambra: Cement, 1 mile.
Azuza: Considerable contemplated.
Burlingame: $75,000 worth now in progress.
Fresno: $10,000.
Huntington Beach: Cement, about ½ mile.
Imperial: Cement, 14 miles, 4 feet wide.
Inglewood: Cement, 155,000 sq. ft.
Lodi: Cement, 7,000 lin. ft.
Los Angeles: Cement, 75 miles.
Oakland: Cement, 31 miles.
Oroville: Cement, 1 mile, 5 feet wide.
Palo Alto: Cement, 6,000 ft.
Pasadena: Cement, 6,000 ft.
San Bernardino: 4 miles.
Sonoma: Several blocks probable.
Vallejo: Cement, 30,000 sq. yds.
Visalia: 2 miles.

COLORADO.

Ft. Collins: $4,000.
Grand Junction: 2 miles.

CONNECTICUT.

Ansonia: 3,000 ft.; material not designated.
Derby: ½ mile.
Middletown: This is done in small individual lots by local contractors.
Southington: Cement, 25,000 sq. ft.
Torrington: Cement,, 5,000 lin. ft.
Tar, 3,000 lin. ft.
Wallingford: Cement, 1,000 ft. 7.5-ft. walk.

DISTRICT OF COLUMBIA.

Washington: Sidewalks, cement, $220,000.
Alleys, brick and asphalt block.

FLORIDA.

Dade City: Cement, 2,000 sq. yds.

GEORGIA.

Americus: 3 miles.
La Grange: Cement, 1 mile of 6-ft. walks.

IDAHO.

Boise City: 18 miles.
Weiser: Cement, 64,000 sq. yds.

ILLINOIS.

Alton: Cement, 1 mile.
Bloomington: Cement, 15 miles.
Canton: Brick, 1 mile.
Cement, 5 miles.
Carlinville: Cement, 20,000 sq. ft.
Centralia: Cement, 20,000 lin. ft.
Stone, 100,000 sq. ft.
Chicago Heights: Cement, 10,000 lin. ft.
Dixon: Cement, 5,000 sq. ft.
East St. Louis: 40 miles.
Edwardsville: Cement, 150,000 sq. ft.
Elgin: Cement, 10 miles.
Granite City: Cement, 38,000 sq. ft.
Lake Forest: Cement, probably 3,000 lin. ft. 5-ft. walk.
Mattoon: Cement, 10,000 sq. ft.
Moline: Cement, 8 miles.
Normal: Cement, 24,000 sq. ft.
Oak Park: 9 miles.
Olney: Cement; amount not decided.
Pekin: All cement, 3 miles.
Quincy: Cement, 150,000 sq. ft.
Rockford: Cement, 10 miles.
Streator: Brick, about 5,000 sq. ft.
Cement, about 10,000 sq. ft.
Taylorville: 15 miles.
Waukegan: Cement, 10,000 sq. ft.
Wood River: 4,000 sq. yds.

INDIANA.

Anderson: Cement, 4,000 lin. ft., 5-ft. wide.
Bloomington: Cement, 10,000 lin. ft.
Connersville: Cement, 25,000 sq. ft.
Covington: Cement, 4,300 sq. ft.
Crawfordsville: Cement, 17,000 sq. ft.
Fort Wayne: Cement, 10 miles.
Gary: Cement, 50,000 sq. yds.
Hartford City: Cement, 4,400 sq. yds.
Huntington: Repairs only.
Lafayette: Cement, 6,850 ft. long, 5-ft. wide.
2,398 ft. long, 5-ft. wide.
1,140 ft. long, 5-ft. wide.
North Vernon: Cement, 1,500 sq. yds.
Plymouth: A little.
Portland: 2 miles.
Richmond: Cement, 10,770 lin. ft.
Terre Haute: Not determined yet by Board of Works.

IOWA.

Burlington: Cement, 3 miles 4-ft. walk.
Cedar Rapids: Cement, 6 miles.
Clinton: Cement, 10,000 sq. ft.
Hamburg: Cement, 500.
Independence: Cement, about 2½ miles.
Muscatine: 6 miles.
Nevada: Cement, 3,000 sq. yds.
Oskaloosa: Cement, about 2 miles.

KANSAS.

Arkansas City: Cement, 10,000 sq. yds.
Emporia: Cement, 3,000 sq. yds., or 1¼ miles.
Ft. Scott: 1 mile.
Girard: Will probably be 10 blocks of concrete and brick sidewalks.
Great Bend: 1 mile.
Manhattan: 2 miles.
Newton: Cement, 6,000 sq. yds.
Osawatomie: 1 mile.
Paola: Cement, 1,000 ft.
Pittsburg: Brick, 3,000 ft.
Salina: Brick, ½ mile.
Cement, ¼ mile.
Topeka: 12 miles.
Wichita: Cement, 3 miles.

KENTUCKY.

Ashland: 1,500 to 2,000 ft.; material not designated.
Earlington: Brick, 1,000 lin. ft., 4 ft. wide.
Cement, 550 lin. ft., 4 ft. wide.
Louisville: 12 miles.
Ludlow: 1 mile.
Owensboro: 2 miles.
Paducah: Cement, 25,000 sq. ft.
Pikeville: Have established grades and adopted specifications for all sidewalks in the town.
Cement, probably 1,000 ft., 5 and 6-ft.

MAINE.

Lewiston: Brick, usual amount.
Cement, usual amount.
Pittsfield: A little.
Rockland: Tar concrete, 2,500 sq. yds.

MARYLAND.

Baltimore: 30 miles.

MASSACHUSETTS.

Fitchburg: Several granolithic sidewalks.
Lawrence: Cement, about 1 mile.
Tar concrete, between 3 and 4 miles.

Lowell: 2 miles.
Southbridge: Cement, 4,000 lin. ft., 6 ft. wide.
Westfield: Cement, 2,000 sq. yds.
Tar concrete, 200 sq. yds.

MICHIGAN.

Alpena: Cement, probably 1½ miles.
Cadillac: 1 mile.
Escanaba: ½ mile.
Highland Park: Cement, 25,000 to 40,000 lin. ft. 6-ft. walk.
Holland: Cement, 1 mile.
Port Huron: Cement, about 4,000 sq. yds.
Saginaw: Cement, depends on amount allowed by Board of Estimates.

MINNESOTA.

Albert Lea: Cement, 1 mile.
Bemidji: 1 mile.
Fergus Falls: About 3,000 sq. yds cement.
Mankato: Cement, 1½ miles.
Minneapolis: Cement, 30 miles.
Montevideo: Cement, 2000 lin. ft.
South St. Paul: 2 miles.
Winona: Cement, 2000 lin. ft. (by city).

MISSISSIPPI.

Clarksdale: Cement concrete, 2,500 sq. yds.
Hattiesburg: Cement, 1 mile (private).
Vicksburg: 2 miles.

MISSOURI.

Columbia: Cement, 14,939 sq. ft.; part let and more to come up later.
Fulton: Cement, 2 miles 4-ft. walk.
Hannibal: Cement, 4 miles.
Jefferson City: All cement; cannot estimate amount.
Kansas City: Cement, 25 miles, all 5 ft. wide.
Kirksville: 8 miles.
Liberty: Cement, 2,200 sq. yds.
Nevada: Brick, 1,000 lin. ft.
Cement, 3,000 lin. ft.
Poplar Bluff: Cement, 3 miles.
Sedalia: Cement, 10 miles.
Springfield: Cement, 10 miles.
Webb City: Cement, 3 miles.

MONTANA.

Bozeman: 4 miles.
Dillon: Cement, 5,000 lin. ft., 6-ft.
Great Falls: Cement, 120,000 sq. ft.
Helena: Cement, 30,000 sq. yds.
Lewistown: Cement, 4,000 lin. ft., contemplated.

NEBRASKA.

Falls City: Cement, 1,000 sq. yds.
Lincoln: Brick, ½ mile.
Cement, 9 miles.
Norfolk: Cement, 2 miles.
Tecumseh: 1 mile.
University Place: Cement, ¼ mile.

NEVADA.

Reno: Cement, 3 miles.

NEW HAMPSHIRE.

Laconia: 1 mile.

NEW JERSEY.

Bayonne: 16 miles.
Dover: Put down by property owners.
Newark: Cement, 5 miles.
Stone, 3 miles.
Ocean City: Cement, 60,000 sq. ft.
Gravel, 20,000 sq. ft.
Plainfield: Mainly done by private owners.
Ridgewood: Done by property owners.
Rutherford: Cement, about 1 mile.
South Orange: Cement, 1 mile.
West New York: Cement, 20,000 sq. ft.
Stone, 32,000 sq. ft.

NEW YORK.

Binghamton: Cement, 25,000 lin. ft., 5 ft. wide.
Cortland: Cement, 1 mile.
Elmira: Cement, 4 miles.
Hudson: 4 miles.
Ilion: Cement, 4,000 lin. ft.
Jamestown: 8 miles.
Niagara Falls: Cement, 3 miles.
Norwich: By private contract.
Ogdensburg: Cement sidewalks, 10,000 sq. yds.
Schenectady: Cement, 14,500 sq. yds.
Syracuse: Cement, 7 miles.
Watertown: Cement, 6 miles.

NORTH CAROLINA.

Greensboro: Cement, 10,000 ft.
Lumberton: Cement, 2,500 ft.
Rocky Mount: Cement, about 20,000 yds.; contract already let at 99 cents per sq. yd.
Wilmington: Cement, 10,000 sq. yds.

NORTH DAKOTA.

Bismarck: Cement, 1,200 sq. yds.
Dickinson: 1 mile.
Minot: Cement, 1 mile.
Valley City: 2 miles.
Williston: Cement, 7,320 sq. yds.

OHIO.

Barberton: Cement or stone, 5,000 ft. of 6-ft. walk.
Bowling Green: 1 mile.
Cambridge: Cement, 3,000 sq. yds.
Canton: Cement, 58,000 sq. ft.
2½-in. sawed stone, 11 miles, 5 ft. wide.
Carrollton: Brick, ½ mile.
Chillicothe: Cement, walks, curbs and gutters, 6,000 lin. ft.
Conneaut: Cement, 6,000 lin. ft.
Lorain: Cement, 10,000 sq. yds.
Massillon: Cement, 4,000 lin. ft.
Stone, private work.
Newark: Cement, 8 miles.
Niles: Cement, 1,000 lin. ft.
Stone, 8,000 lin. ft.
Pomeroy: 1 mile.
Ravenna: Cement and stone; repairs and extensions; amount not yet determined.
Springfield: Cement, 15,000 sq. yds.
Steubenville: Cement, 1 mile.
Tiffin: Sidewalks are built by the property owners.
Wooster: Stone, 5 miles.

OKLAHOMA.

Chandler: 3 miles.
Clinton: 1 mile.
Durant: 2 miles.
El Reno: 2 miles.
Okmulgee: 8 miles.
Tulsa: 3 miles.

OREGON.

Coquille: Cement, 9,400 ft.
Wood, 1,500 ft.
Eugene: Cement, 3,000 lin. ft., 5 ft. wide.
Wood, 1,200 lin. ft., 6 ft. wide.
Grant's Pass: 5 miles.
McMinnville: 5 miles.

PENNSYLVANIA.

Catasauqua: Cement, 600 lin. ft.
Dravosburg: Cement, 7,000 sq. yds.
Du Bois: Stone, uncertain.
Erie: Cement, 8,000 ft.
Farrell: Cement or stone, 5,000 ft.
Hanover: There will be quite a great deal of sidewalk work done here this year, but have no way of telling how much nor kind at this time, but either of brick or cement.
Harrisburg: Not done by city; 15 miles.
McKees Rocks: Cement, 2,000 sq. yds.

Meadville: 3 miles.
Monongahela: Cement, 10,000 lin. ft.
New Brighton: Cement, 3,000 sq. yds.
Norristown: 2 miles.
Ridgway: Built by property owners.
Sayre: Cement, 2,000 ft. in detached sections put in by property owners.
Sharpsville: Cement, ¼ mile.
Swissdale: Cement, about 15,000 sq. ft.
Titusville: Cement, 2 miles, by property owners; none by city.
Wilkes-Barre: 3 miles.
York: Cement, 9,013 sq. yds.

RHODE ISLAND.

East Providence: Tar concrete, 4,000 sq. yds.
Woonsocket: Tar concrete, about 3,000 sq. yds.

SOUTH CAROLINA.

Columbia: Cement, $20,000.

SOUTH DAKOTA.

Aberdeen: 4 miles.
Mitchell: 3 miles.
Sioux Falls: Cement, 500 yds.

TENNESSEE.

Memphis: Cement, 500,000 sq. ft.

TEXAS.

Bryan: 2 miles.
Paris: Cement, 5 miles or more.
Waxahachie: Cement, 5 miles.

UTAH.

Ogden: 8 miles.
Salt Lake City: Cement, 30 miles.

VERMONT.

Barre: Cement, 2,500 sq. yds.
Bellows Falls: Cement, ½ mile. Tar concrete, 1 mile.

VIRGINIA.

Newport News: Cement, about 1 mile.

WASHINGTON.

Aberdeen: Cement, 12,000 sq. yds. Wood, 5,000 lin. ft.
Pullman: Cement, by property owners on order of city.
Seattle: Cement, 200,000 sq. yds. Wood, 1,500,000 ft. B. M.
Tacoma: $90,000.
Walla Walla: Cement, 50,000 sq. ft.

WEST VIRGINIA.

Parkersburg: Cement, 50,000 sq. yds.

WISCONSIN.

Appleton: 8 miles.
Baraboo: 1 mile.
Burlington: Cement, 6,000 lin. ft.
Kenosha: 4 miles.
Eau Claire: Cement, ¾ mile.
Madison: Cement, laid by contractors for owners.
Marinette: Cement, 10,000 lin. ft. of 6-ft. walk.
Oshkosh: Cement, about 12 miles.
Port Washington: Cement, 1,000 ft.
Sheboygan: Cement, 18,000 lin. ft.
Waukesha: 6 miles.
Waupaca: Cement, 19,800 sq. ft.

CANADA:

Chatham, Ontario: Cement, 50,000 sq. ft.
Guelph, Ontario: Cement, 78,030 sq. ft., or 3 miles.
Hamilton, Ontario: Cement, 6,000 ft.
Lethbridge, Alberta: Cement, 3 miles. 5 ft. and 6 ft. wide.
London, Ontario: Cement, 10,000 ft.; width, 5 ft.
Ottawa, Ontario: Cement, 10 miles. Wood, ½ mile.
Regina, Sask.: Cement, 65,000 sq. yds.
Vancouver: Not yet outlined.

NOVA SCOTIA.

Halifax: Cement, 10,000 yds.

STREET GRADING FOR 1913

Grading without paving is included in this list.

ALABAMA.

Dothan: City grading force is reworking all streets in city limits.
Gadsden: $10,000.

ARIZONA.

Nogales: A little.

CALIFORNIA.

Alhambra: 4 miles.
Fresno: $50,000.
Inglewood: 43,000 cu. yds.
Lodi: About 200,000 cu. yds.
Los Angeles: 30 miles.
San Bernardino: A little.
Sierra Madre: 3,000 lin. ft.
Vallejo: 50,000 cu. yds.
Visalia: $30,000.
Willits: About 1,600 ft.

COLORADO.

Ft. Collins: A little.

CONNECTICUT.

Ansonia: Not determined yet.
Hartford: $22,000.
Southington: 1,000 ft.; about 5 miles state highway.

DISTRICT OF COLUMBIA.

Washington: Included in "New Work," given under Paving and Sidewalks.

FLORIDA.

Dade City: 6 miles.

GEORGIA.

La Grange: Cut one hill about 10,000 cu. yds., and grading for sidewalks about 5,000 cu. yds.

IDAHO.

Weiser: 65,000 cu. yds.

ILLINOIS.

Alton: 10,000 yds. of grading and shaping streets.
Carlinville: A little.
East St. Louis: 151,220 cu. yds.
Edwardsville: 2 miles.
Galesburg: 26,950 cu. yds.
Greenville: A little.
Moline: 50,000 cu. yds.
Newton: 2,960 cu. yds.
Oak Park: 86,800 cu. yds.
Pekin: Street grading, one-third of sq. yds. of pavement, goes with paving.
Quincy: 55,000 cu. yds.
Waukegan: 15,000 cu. yds.

INDIANA.

Bloomington: A little.
Connersville: 2,500 lin. ft.
Crawfordsville: 2,467 lin. ft. grading and graveling.
Evansville: $100,000 grading, curbs and gutters.

Fort Wayne: A little.
Lafayette: 3,680 ft. gravel roadway.
Portland: A little.
Richmond: 2,600 ft.

IOWA.

Burlington: 30,000 cu. yds.
Dubuque: 20,000 cu. yds.
Fort Madison: 9,500 cu. yds.
Hamburg: 1 mile.
Independence: Cut and fill, about 5,000 yds.
Muscatine: $9,500.
Nevada: About $1,000 appropriated for grading the transcontinental route thru city.
Oskaloosa: Probably a mile of streets will be graded this year.

KANSAS.

Chanute: 6,000 sq. yds. light work.
El Dorado: One street, about 2,000 ft. long and 30 ft. wide.
Emporia: 23,000 cu. yds.
Fort Scott: A little.
Great Bend: A little.
Oswatomie: A little.
Paola: 4,500 cu. yds.
Topeka: $10,000.

KENTUCKY.

Ludlow: A little.
Owensboro: A little.
Paducah: None in sight yet, but we always do about 1½ miles of grading and graveling streets during year.

MAINE.

Saco: $7,000.

MASSACHUSETTS.

Lowell: $5,000.
Southbridge: 3 mi. of drainage and subgrade.

MICHIGAN.

Cadillac: A little.
Escanaba: A little.
Grand Rapids: 100,000 cu. yds.
Highland Park: Several street opening jobs which will probably be handled by Department of Public Works.
Holland: 10,000 yds.

MINNESOTA.

Albert Lea: 18,000 cu. yds.
Bemidji: A little.
Faribault: 1 mile, gravel.
Mankato: ½ mile.
Montevideo: A little.
South St. Paul: $25,000.
Winona: A little.

MISSISSIPPI.

Vicksburg: $5,000.

MISSOURI.

Columbia: 7,727 cu. yds. excavation in conjunction with the paving, and will be or has been let in the same contract. 6,099 cu. yds. embankment, as above.
Fulton: 10,000 cu. yds.
Hannibal: 1½ miles.
Kansas City: 25 miles ;costing $230,000.
Liberty: 27,000 cu. yds.
Sedalia: 1 mile, 30 ft. wide.
Webb City: 1½ miles.

MONTANA.

Great Falls: 1 mile, boulevard.
Helena: 3 mi.

NEBRASKA.

Lincoln: Between 7,000 and 8,000 cu. yds.
Norfolk: 2,000 cu. yds.
Tecumseh: 2,500 cu. yds.
University Place: 8 blocks.

NEVADA.

Reno: 5 miles.

NEW HAMPSHIRE.

Laconia: $4,000.
Littleton: 2,600 ft.

NEW JERSEY.

Bayonne: $8,000.
Beach Haven: Ocean boulevard, from Beach Haven to bridge, 7 miles, at cost of $15,000; 60 per cent. and 40 per cent. paid by county and state, respectively. (Gravel.)
Newark: 4 miles.
Ocean City: 4,000 ft.
Rutherford, Boro of: About 1 mile.
Trenton: 1,000 cu. yds.
West New York: 2 miles.

NEW YORK.

Binghamton: Done by street department as required; no data.
Jamestown: $10,000.
Schenectady: 10,000 cu. yds.
Syracuse: 4 miles.

NORTH CAROLINA.

Greensboro: 10,000 cu yds.
Wilmington: Small amount; number of cu. yds. not definite.

NORTH DAKOTA.

Bismarck: 25,000 cu. yds.
Dickinson: A little.
Minot: 2 miles.
Valley City: $3,000.
Williston: 3,000 ft.

OHIO.

Bowling Green: A little.
Canton: 140,000 cu. yds.
Carrollton: 2,000 cu. yds.
Conneaut: 2,200 lin. ft.
Fostoria: About three acres of cemetery to be laid out.
Massillon: 15,000 cu. yds.
Steubenville: 8,000 cu. yds.
Wellsville: 3,000 cu. yds.

OKLAHOMA.

Clinton: $5,000.
El Reno: A little.
Okmulgee: A little.
Tulsa. $25,000.

OREGON.

Coquille: 36,000 cu. yds.
Eugene: Some very light work.
Grants Pass: $7,000.

PENNSYLVANIA.

Athens: 1,200 ft.
Catasauqua: 500 cu. yds.
Dravosburg: 18,000 cu. yds.
Farrell: Very little, except grading for our paved streets, contemplated.
Hanover: About 800 cu. yds. in prospect.
Harrisburg: 2,305 lin. ft.
McKees Rocks: 10,000 cu. yds.
New Brighton: $5,000.
New Castle: 20,000 cu. yds.
Norristown: A little.
Sayre: 1,200 ft. for paving.
Swissvale: 19,000 cu. yds.
Titusville: Ordinary repairs.

RHODE ISLAND.

East Providence: 4,200 lin. ft.

SOUTH CAROLINA.

Columbia: 10,000 cu. yds.; contracts let.

TENNESSEE.

Columbia: 7,700 ft. in length.
Memphis: 100,000 cu. yds.

TEXAS.

Bryan: $40,000.
El Paso: $50,000.

UTAH.

Ogden: $10,000.
Salt Lake City: 10 miles.

VIRGINIA.

Newport News: About 12,000 cu. yds.

WASHINGTON.

Aberdeen: 500,000 cu. yds., of which four-fifths is already contracted.
Grandview: 4,000 ft.
Hoquiam: 50,000 cu. yds. filling.
Seattle: 3,000,000 cu. yds. grading.
Tacoma: $200,000.

WISCONSIN.

Appleton: $5,000.
Baraboo: A little.
Kenosha: $18,000.
Port Washington: 5,000 yds.
Sheboygan: 6,000 yds.
Waukesha: 21,042.60 cu. yds.

CANADA.

Guelph, Ontario: About 5 miles.
Hamilton, Ontario: 32,000 cu. yds.
Lethbridge, Alberta: 1 mile.
London, Ontario: 2,000 ft.
Ottawa, Ontario: Not decided yet.
Prince Rupert, B. C.: $160,000 grading.
Regina, Sask.: 20 miles.

NOVA SCOTIA.

Halifax: 4,000 ft.

CURB AND GUTTER FOR 1913

Curb and gutter on streets which are not paved are included in this list.

ALABAMA.

Dothan: Indefinite.
Gadsden: Concrete, 2 miles.
Jasper: Concrete, 1 mile.

ARKANSAS.

Paragould: Concrete, 20,000 ft.

CALIFORNIA.

Alhambra: Concrete, 4 miles.
Colton: Brick or concrete, 24,000 sq. ft.; have not decided which material.
Huntington Beach: Concrete, 1 mile.
Imperial: Concrete, 10 miles.
Inglewood: Concrete, 31,610 lin. ft. curb; 63,220 sq. ft. gutter.
Lodi: Concrete, about 7,000 lin. ft. curb and gutter.
Los Angeles: Brick and cement gutter, 10 miles.
Concrete curb, 90 miles.
Oroville: Concrete, 1 mile.
Palo Alto: Concrete, 10,000 sq. ft.
Pasadena: Concrete, 5,000 ft.
Vallejo: Concrete, 50,000 lin. ft.
Willits: Concrete, 7,000 ft.

CONNECTICUT.

Ansonia: Granite, 5,000 ft.
Middletown: Considerable repair of macadam streets.
Torrington: Concrete, 5,500 lin. ft.
Cobble, 2,000 lin. ft.
Wallingford: Concrete, 1,000 ft.
Blue stone, 2,000 ft.

DISTRICT OF COLUMBIA.

Washington: Brick gutter and granite curb, included in resurfacing and new work.

IDAHO.

Weiser: Concrete, 90,000 lin. ft.

ILLINOIS.

Alton: Concrete, 5 miles.
Assumption: Sandstone, 3,076 ft. let; 10,800 ft. not let.
Bloomington: Concrete, 31,862 lin. ft.
Sandstone, 4,091 lin. ft.
Canton: 35 miles; material not decided.
Carlinville: Concrete, 4,000 lin. ft.
Chicago Heights: Concrete, 12,000 lin. ft.
Dixon: Concrete curb, 10,000 lin. ft.
East St. Louis: Concrete, 1,000 ft. (combined curb and gutter).
Sandstone, 107,982 ft.
Concrete marginal curb, 46,807 ft.
Edwardsville: Concrete, 3,500.
Elgin: Concrete, 7½ miles.
Galesburg: Concrete, 32,330 lin. ft.
Sandstone, 2,230 lin. ft.
Granite City: Granite, 5,200 lin. ft.
Moline: Concrete, 60,000 ft.
Newton: Concrete, 5,632 lin. ft.
Normal: Concrete, 8,000 ft.
Oak Park: Concrete, 28 miles.
Olney: Brick; can not say.
Concrete; can not say.
Pekin: Concrete, 5,000 lin. ft. new.
Sandstone, 15,000 lin. ft. re-set.
Quincy: Concrete, about 6 miles.
Sandstone, about 4,000 ft.
Rockford: Concrete, 20,000 lin. ft.
9,300 lin. ft. curb only.
Streator: Concrete, 3,600 ft.
Sandstone, 2,600 ft.
Waukegan: Concrete, 20,000 ft. combined curb and gutter.
Sandstone, 1,050 ft.
Wood River: Concrete, 20,000 lin. ft.

INDIANA.

Bloomingon: Concrete, 5,000 ft.
Connersville: 5,000 ft.
Covington: Concrete, 5,200 ft. curb.
Crawfordsville: Concrete, 30,655 lin. ft.
Fort Wayne: None, except in connection with new paved streets.
Gary: Concrete, 85,000 ft.
Hartford City: Concrete, about 15,000 lin. ft.
Lafayette: Concrete, 3,820 lin. ft.
North Vernon: Concrete, 2,500 lin. ft.
Richmond: Concrete, 9,391 ft.

IOWA.

Burlington: Concrete, 20,200 curb.
Cedar Rapids: Concrete, 60,000 lin. ft.
Clinton: Concrete, 10,000 lin. ft.
Corning: Concrete, 17,000 ft.
Dubuque: Concrete, 20,000 lin. ft.
Limestone, 2,000 lin. ft.
Eagle Grove: Cement, about 16,000 ft.
Fort Madison: Concrete, 11,400 lin. ft.
Hamburg: Concrete, 8,000 ft.
Independence: Concrete, 14 blocks, combined curb and gutter.
Nevada: Concrete, about 15 blocks combined curb and gutter. Possibly 10 more.
Newton: Concrete, 24,000 ft.
Oskaloosa: Concrete, possibly 10 to 20 blocks.
Webster City: Concrete, about 20,000 ft.

KANSAS.

Arkansas City: Concrete, 10,000 lin. ft.
Chanute: Concrete, 3,000 ft. curbing and gutter.
El Dorado: Concrete, not certain, but probably about 4,000 lin. ft.
Emporia: Concrete, 12,000 lin. ft. combined curb and gutter.
Girard: Concrete, 1,300 ft., contract let; will probably be more.
McPherson: Concrete, about 3 miles.
Newton: Concrete, 5 miles.
Ottawa: Concrete, 5,700 lin. ft.
Paola: Concrete, 10,000 ft.
Pittsburgh: Concrete, 40,000 ft.
Salina: Concrete, 2 miles.
Wichita: Concrete, 2 miles.

KENTUCKY.

Ashland: Very little.
Paducah: Granite, 4,000 ft.
Pikeville: Concrete, 20,000 lin. ft. combined curb and gutter.

LOUISIANA.

Baton Rouge: Are talking of issuing bonds for some curbs and gutters, etc., but nothing definite.
New Orleans: Vitrified brick gutter bottoms.
Combined concrete curb and gutter, 36,000 lin. ft.
Concrete curb, 26,600 lin. ft.
Granite curb, 18,700 lin. ft.
31,900 lin. ft.

MASSACHUSETTS.

Lawrence: Between 3 and 4 miles.
Southbridge: Concrete, 4,000 ft. long, 2-foot wide.
Westfield: Concrete, 300 lin. ft.

MICHIGAN.

Alpena: Concrete, probably 3,500 lin. ft., curb without gutter.
Hastings: Concrete, curb and gutter for 16 blocks.
Highland Park: Concrete, as required for paving work.
Hillsdale: Concrete, about 1 mile.
Holland: Concrete, 4 miles|
Port Huron: Concrete curb, 2 miles.
Saginaw: Concrete, 15,000 ft. combined curb and gutter.
Medina curb, 9,000 ft.

MINNESOTA.

Albert Lea: Concrete, 6 miles without gutter.
Faribault: Sandstone, 6,000 ft.
Mankato: Concrete, 1 mile.
Minneapolis: Concrete, 70 miles.
Granite, 2 miles.
Montevideo: Concrete, 600 lin. ft.
Stillwater: Concrete, possibly ½ mile.
Winona: Limestone, 1,500 ft.

MISSISSIPPI.

Clarksdale: Concrete, 1,000 lin. ft.

MISSOURI.

Columbia: Concrete, 7,971 lin. ft.
Fulton: Concrete, 2,500 ft.
Hannibal: Concrete, 20,000 lin. ft.
Jefferson City: Concrete, 6 miles.
Kansas City: Concrete, 32 miles.
Kirksville: Concrete, 5,300 lin. ft.
Liberty: Concrete, 10,000 lin. ft.
Nevada: Concrete, 2,000 lin. ft.
Poplar Bluff: Concrete, 4 miles.
Sedalia: Concrete, 3 miles.
Springfield: Concrete, 7 miles.
Limestone, 7 miles.
Webb City: Concrete, 2 miles.

MONTANA.

Dillon: Concrete curbs, 1,000 lin. ft.
Great Falls: Concrete, 30,000 lin. ft. curb.
Helena: Concrete, 30,000 lin. ft.
Lewistown: Brick, contemplated, 4,000 yds.

NEBRASKA.

Falls City: Concrete, 5,000 ft.
Lincoln: Concrete, about 7 miles.
Norfolk: Concrete, 40,000 lin. ft.
University Place: Concrete, 6 blocks.

NEVADA.

Reno: Concrete, 2 miles.
Granite, 1 mile.

NEW JERSEY.

Ocean City: Bluestone, 10,000 lin. ft.
Plainfield: Mainly done by private owners.
Ridgwood: Concrete, 700 ft. gutter.
Rutherford, Boro. of: Concrete, about 1 mile.
South Orange: Brick, 2 miles gutter.
Concrete, 3 miles curb.
Westfield: Concrete, 3¼ miles.
West New York: Bluestone, 3,000 ft.

NEW YORK.

Binghamton: Concrete, 10,000 lin. ft.
Cortland: Concrete, 6,000 lin. ft.
Elmira: Concrete, 3,000 lin. ft.
Sandstone, 12,000 lin. ft.
Ilion: Concrete, 2 miles combined curb and gutter.
Niagara Falls: Laid only with new pavement.
Norwich:. Built by property owners.
Ogdensburg: Concrete curb and gutter, 8,000 ft.
Rye: Brick, 5,000 lin. ft. gutters.
Bluestone, 5,000 lin. ft. curb.
Schnectady: Granite, 45,000 lin. ft.
Bluestone, 2,000 lin. ft.
Syracuse: Concrete, 2 miles.
Sandstone, 10 miles, curb.
Watertown: Concrete, 1 mile.

NORTH CAROLINA.

Greensboro: Granite, 10,000 ft.
Rocky Mount: Granite, about 3 miles.
Wilmington: Granite, 15,000 ft.

NORTH DAKOTA.

Bismarck: Concrete, 3,000 lin. ft.
Minot: Concrete, 20,000 ft.
Williston: Concrete, 12,560 ft.

OHIO.

Barberton: Concrete curb and gutter, 4,200 ft.
Sandstone curb, 5,538 ft., 18x4-inch.
Bowling Green: Sandstone, 2,500 ft.
Bryan: Cement curb and gutter, for 25,200 sq. yds. paving.
Cambridge: Sandstone, Berea curb for 22,500 sq. yds. of pavement.
Canton: Stone curb, 14 miles, 6x18-inch.
Carrollton: Sandstone, 1,100 lin. ft.
Chillicothe: Curbs and gutter for 6,000 lin. ft. cement walk.
Conneaut: Concrete, 4,400 lin. ft.
Coshocton: Sandstone, 6,300 sq. yds.
Massillon: Brick, 10,200 ft. block gutter.
Concrete, 5,000 lin. ft.
Sandstone, 5,200 lin. ft.
Newark: Concrete, 25,143 lin. ft. curb, 6-inch by 16-inch.
Paulding: Concrete curb and gutter.
Pomeroy: Concrete, 4,000 ft.
Ravenna: Brick or concrete, 6,865 ft.
Springfield: Concrete, 14,000 ft.
Steubenville: Concrete, 2 miles.
Tiffin: Concrete curb for 2,615 sq. yds. concrete paving.
Sandstone curb for 14,800 sq. yds. brick paving.
Wellsville: Concrete, 7,000 ft.
Wooster: Sandstone, 20,000 lin. ft. curb.
Zanesville: Concrete curb, 55,000 lin. ft.

OKLAHOMA.

McAlester: Concrete, 2,000 ft.

OREGON.

Coquille: Concrete, 32,000 lin. ft.
Red cedar, 2,600 lin. ft.
Eugene: Concrete, 55,000 lin. ft.

PENNSYLVANIA.

Athens: Concrete, about 2,400 lin. ft.
Catasauqua: Concrete, 600 lin. ft.
Dravosburg: Concrete, 7,000 lin. ft.
DuBois: Concrete, 3,000 lin. ft.
Erie: Concrete, 11,000 ft. curb.
Farrell: Concrete, granite, limestone or sandstone, 5,000 ft. curb.
Hanover: Concrete, 25,000 lin. ft.
Harrisburg: Granite, 53,352 lin. ft.
McKees Rocks: Concrete, 10,000 lin. ft.
Sandstone, 5,000 lin. ft.
Monongahela: Concrete, 12,800 lin. ft.
New Brighton: Concrete, 2,500 ft.
New Castle: Brick, 5 miles.
Concrete, 10,000 ft.
Sandstone, 10,000 ft.
Ridgway: Sandstone curb for 11,000 sq. yds. brick pavement.
Sayre: Concrete, 2,400 ft.
Sharpsville: Very little, if any.
Swissvale: Concrete, 15,000 lin. ft.
York: Concrete, 30 miles curb.

RHODE ISLAND.

Woonsocket: Granite, about 1 mile.
Sioux Falls: Concrete, 10,000 lin. ft.

TENNESSEE.

Memphis: Concrete, 100,000 sq. ft. of "water table."
Concrete curb and gutter, about 20,000 lin. ft.

TEXAS.

Paris: Concrete, 27,000 ft.
Waxahachie: Concrete, 5 miles.

UTAH.

Ogden: Concrete, 15,500 lin. ft.
Plain concrete gutter, 5,229 ft.
Salt Lake City: Concrete, 11.5 miles.

VERMONT.

Barre: Concrete, 1,000 ft.

VIRGINIA.

Danville: Appropriations not made.
Newport News: Concrete, 21,000 lin. ft. curb and gutter.

WASHINGTON.

Aberdeen: Concrete curb, 28,000 lin. ft.
Pullman: Concrete, 2,000 ft.
Seattle: Concrete, 30,000 lin. ft.
Granite, 15,000 lin. ft.
Reinforced concrete, 50,000 lin. ft.
Wood, 400,000 lin. ft.
Walla Walla: Concrete, 6,000 lin. ft.

WEST VIRGINIA.

Parkersburg: Concrete, 30,000 ft.

WISCONSIN.

Delavan: Concrete, 5,130 lin. ft.
Eau Claire: Concrete gutter, 1 mile.
Madison: Concrete, 30,000 ft.
Oshkosh: Concrete, 30,000 ft.
Port Washington: Not determined.
Sheboygan: Concrete, 36,000 ft.
Limestone, 2,000 ft.
Waukesha: Concrete, 26,500 lin. ft.
Waupaca: Concrete, 6,200 lin. ft., curb only.

CANADA.

Chatham, Ontario: Concrete, 2,400 ft.
Guelph, Ontario: 15,400 ft. of combined curb and gutter.
Hamilton, Ontario: Brick, 25,000 yds.
Concrete, 6,000 ft.
Lethbridge, Alberta: Concrete, 2 miles.
Plank, 2 miles.
London, Ontario: All concrete; can not give length.
Ottawa, Ontario: Concrete, 2 miles.
Regina, Sask.: Concrete, 80,000 lin. ft.
Vancouver, B. C.: Not yet outlined.

NOVA SCOTIA.

Halifax: Concrete, 10,000 ft.
Granite, 5,000 ft.

SEWERS TO BE CONSTRUCTED IN 1913

ALABAMA.

Dothan: Plain concrete, 3,000 ft. 36 inch.
Vitrified pipe, new trunk lines of sanitary sewer. Survey not being made the size and length are not definitely known.
4,000 lin. ft. of open ditch outlet.
Gadsden: Vitrified pipe, 3,000 ft. 6-inch sanitary. City will do work.
Jasper: Vitrified pipe, 24,000 ft.

ARIZONA.

Nogales: A $50,000 system will be built.

CALIFORNIA.

Alhambra: Reinforced concrete, 8,000 ft.
Fresno: Pipe sewers, $10,000.
Hanford: Will issue $90,000 bonds for sewer extensions.
Huntington Beach: Vitrified pipe, complete system for ½ square mile area, from 6-inch to 15-inch and 45 manholes and catch basins; 1,000 ft. 12-inch c. i. outfall into ocean; estimated cost, $46,000.
Imperial: Vitrified pipe, 4,000 ft.
Inglewood: Corrugated iron, 7,300 lin. ft., 5-foot diameter.
Lodi: Plain concrete, 1,300 ft.
Vitrified pipe, 8,581 ft.
Los Angeles: Brick, plain concrete, reinforced concrete, vitrified pipe, 100 miles.
Oakland: Sanitary sewers (last year), 81 miles.
Storm sewers (last year), 3 miles.
Oroville: Vitrified pipe, 7,500 ft., 12-inch to 24-inch storm sewer; bids closed.
Pasadena: Vitrified pipe, 4 mi.
Small sewage pumping plant.
San Bernardino: Sewer pipe lines, $90,000.
Santa Monica: Making extensions.
Vallejo: Vitrified pipe, 5,000 lin. ft.
Visalia: Some short sewer lines.

COLORADO.

Ft. Collins: Some short lines.

CONNECTICUT.

Ansonia: Vitrified pipe, 12,000 ft.
Middletown: Vitrified pipe; prospective work, data not determined yet.
Southington: System under consideration.
Torrington: Vitrified pipe, 2,000 ft., 24-inch; 3,000 ft. 8-inch.
Segment blocks, 2,800 ft., 42-inch.
Wallingford: Vitrified pipe, 4,000 lin. ft., 12-inch to 24-inch.

DISTRICT OF COLUMBIA.

Washington: Brick, plain concrete, vitrified pipe or other material, $430,000.

FLORIDA.

Dade City: Vitrified pipe, 3,000 lin. ft. 18-inch.
Vitrified pipe, 17,000 lin. ft. 12-inch.
Vitrified pipe, 100,000 lin. ft., 8-inch.
With disposal works contemplated.
Sarasota: $15,000 to be spent on sewer construction.

GEORGIA.

Americus: Sewer lines, $10,000.

IDAHO.

Boise City: A few short lines.
Weiser: Vitrified pipe, 4,057 ft., 6-in.; 28,130 ft., 8-in.; 4,310 ft., 10-in.; 3,240 ft., 12-in.; 3,300 ft., 15-in.; 640 ft., 18-in.; 1,600 ft., 24-in.
105 concrete manholes.
Sewage pumping station.

ILLINOIS.

Alton: Sanitary sewer as follows
Vitrified pipe, 12 miles, 8 to 15-inch and 6-inch laterals for house connections.
Cast iron pipe, 1½ miles, 12-inch to 20-inch in diameter.
Assumption: Vitrified pipe, 8 miles 8-inch to 30-inch; contract let.
Bloomington: Brick, 1,126 ft. of 5-foot.
Vitrified pipe, 15,844 lin. ft. of 24-inch, 20 inch, 15-inch, 12-inch, 10-inch and 8-inch.
Canton: Vitrified pipe, about 8,000 ft.
Carlinville: A few appurtenances will be built.
Centralia: Vitrified pipe, 5 miles extension.
Will remodel septic tank and built two new tanks.
Chicago Heights: Plain concrete, 12,918 lin. ft., 30-inch to 84-inch.
Vitrified pipe, 141,458 lin. ft., 6-inch to 24-inch.
5,000 lin. ft. outlet ditch, ex. 4½ cu. yds. per lin. ft.
DeKalb: Vitrified pipe, about 16 miles, 8-inch to 24-inch.
Dixon: Vitrified pipe, about 10,000 lin. ft.
East St. Louis: Plain Concrete, 5,976 ft. 5-foot, diam.; 5,477 ft. 4½-foot diam.; 4,564 ft. 4-ft. diam.; 6,289 ft. 3½-foot diam.; 7,395 ft. 3-foot. diam.
Reinforced Concrete, 3,768 ft. 7-foot. diam.; 970 ft. 6½-foot diam.; 2,651 ft. 6-foot diam.
Vitrified Pipe, 720 ft. 36-inch diam.; 19,591 ft. 30-inch diam.; 3,792 ft. 27-inch diam.; 27,650 ft. 24-inch diam.; 8,074 ft. 20-inch diam.; 5,360 ft. 18-inch diam.; 11,460 ft. 15-inch diam.; 9,650 ft. 12-inch diam.; 26,000 ft. 10-inch diam.
Sewage pumping station.
Edwardsville: Vitrified pipe, 8,000 ft.
Elgin: Vitrified pipe, 12½ miles 6-inch to 42-inch.
Galesburg: Vitrified pipe, 12,782 lin. ft., 10-inch, 12-inch, 15-inch, 18-inch, 20-inch, 24-inch and 27-inch, inclusive.
Granite City: Vitrified pipe, 4,000 ft., 39-inch.
2,600 ft., 36-inch.
Lake Forest: Vitrified pipe, about 1,000 ft. in all; storm water sewer sewer, 12-inch, 12-inch, 15-inch, 18-inch, 27-inch and 30-inch.
Mattoon: Plain concrete, 640 ft. of 48-inch.
Vitrified pipe, 30 miles, sanitary sewer system.
Moline: Vitrified pipe, 12 miles.
Normal: Vitrified pipe, 2,000 ft.
Oak Park: Some short branches.
Olney: Not yet determined.
Ottawa: Vitrified pipe, about 4 miles, from 6-inch to 30-inch.
Pontiac: Vitrified pipe, 7,500 ft.
Quincy: Brick, 36-inch to 40-inch, 4,200 ft. (contracted).
Vitrified pipe, about 6 miles contracted; about 1 mile prospective.
Rockford: Vitrified pipe, 30,000 lin. ft.
Rock Island: Sewer mains, $30,000.
Waukegan: Vitrified pipe, 5,600 ft.
Wood River: Vitrified pipe, 4,200 ft. 6-in., 300 ft. 12-inch, 500 ft. 15-inch.

INDIANA.

Anderson: Plain concrete, 8,000 ft. 7x9.
Vitrified pipe, 2,000 ft., 42-inch; 1,000 ft. 39-inch; 1,000 ft. 24-inch.
Bedford: Sewer pipe lines, $20,000.
Bloomington: Reinforced concrete, 500 ft., 5 ft. by 6 ft.
Vitrified pipe, 10,000 ft.; sanitary and storm.
Boonville: Sewer system, $75,000.
Crawfordsville: Vitrified pipe, 750 lin. ft., 24-inch; 957 lin. ft., 30-inch; 400 lin. ft., 10-inch.
Evansville: Sewer extensions, $16,000.
Fort Wayne: Vitrified pipe, 9 miles, 12-inch to 36-inch.
Gary: Plain concrete, 18,000 ft.
Vitrified pipe, 28,000 ft.
Hartford City: Vitrified pipe. 4,000 ft. 12-inch.
Huntington: Vitrified pipe, 2,000 ft. 12-inch, and 1,900 ft. 15-inch.
Lafayette: Vitrified pipe—720 ft. 24-inch.
490 ft. 18-inch S. S. pipe.
335 ft. 12-inch S. S. pipe.
Logansport: Very little.
Michigan City: Concrete, 1 mile long, from 24-inch to 36-inch diameter; cost $100,000.
Plymouth: Some short branches.
Portland: Sewer extensions, $10,000.
Richmond: Reinforced concrete, 1,100 ft.
Vitrified pipe, 14,973 ft.
Terre Haute: Not yet determined by board of works.

IOWA.

Burlington: Vitrified pipe, 30,000 ft. 8-inch to 24-inch.
Carroll: Vitrified pipe, about 3 miles of 8-inch sanitary sewer.
Cedar Rapids: Brick, storm sewer, 2,840 ft., 5 and 6-foot.
Vitrified pipe, sanitary sewer, 10,000 ft.
Clinton: Vitrified pipe, 4 miles, 3-inch to 30-inch.
Dubuque: Vitrified pipe, 20,000 ft. 8-inch and 10-inch.
Stone, 500 lin. ft., 14 feet semi-circle.
Independence: Vitrified pipe, 1¼ miles.
Marshalltown: Sewer and water extensions, $25,000.
Muscatine: Some branches will be built; $7,000.
Oskaloosa: Vitrified pipe, 1 to 3 miles, 12-inch to 8-inch in size, sanitary.
Vitrified hollow block, 5,700 ft., storm.
Vitrified pipe, 7,800 ft. 24-inch to 12-inch.
Webster City: Vitrified pipe, about 6,800 ft.

KANSAS.

Arkansas City: Vitrified pipe, 5,000 lin. ft. 8-inch; under construction.
Chanute: Vitrified pipe, 2,100 ft, 8-inch tile.
Emporia: Vitrified pipe, 8,000 ft. 15-inch; 1,500 ft. 14-inch; 6,000 ft. 12-inch; 3,000 ft. 10-inch.
Fort Scott: Large sewer construction, $100,000.
Girard: Vitrified pipe, 4,000 ft. of 8-inch.
Newton: Reinforced concrete, 3,000 ft. of 60-inch.
Paola: Vitrified pipe, 1,500 ft. 8-inch.

Pittsburg: Vitrified pipe, 4,000 ft. of 8-inch.
Salina: Vitrified pipe, 4,000 ft. 30-inch.
Topeka: Sewer extensions, $25,000.
Wichita: Reinforced concrete, 360 lin. ft.
Vitrified pipe, 6,994 lin. ft.

KENTUCKY.

Dayton: Some short branches.
Louisville: Completion of large sewer system in progress; will probably spend $1,000,000 in 1913.
Ludlow: Some small branches.
Pikeville: Vitrified pipe, 2,000 ft. of 30-inch 70 catch-basins, 8-inch inlets; average length inlets, 10 ft.

LOUISIANA.

Baton Rouge: Will spend $50,000 for sewers if bonds are issued as talked of now.
New Orleans: 20 miles of sewers in prospect.

MAINE.

Lewiston: Brick, 700 ft. 48-inch.
Vitrified pipe, about 3,000 ft.
Pittsfield: Small branches.
Rockland: Vitrified pipe, 2,000 ft. of 8-inch and 10-inch.

MARYLAND.

Baltimore: Sewer system under rapid construction; about $2,000,000 construction planned for 1913.

MASSACHUSETTS.

Great Barrington: Not yet determined.
Lawrence: Vitrified pipe, between 1 and 2 miles.
Lowell: Extensions, $50,000.
Southbridge: Vitrified pipe, 3,000 lin. ft. 8-inch.
Westfield: Vitrified pipe, 2,000 ft. 8-inch to 18-inch.

MICHIGAN.

Alpena: Vitrified pipe, about 3,000 ft.
Cadillac: $17,000.
Detroit: Eight sewers as follows:
2,540 ft. 3-ft. cyl., 12, 15, 18 and 27-inch pipe.
1,155 ft., 12-inch pipe.
254 ft., 15-inch pipe.
589 ft., 12-inch to 15-inch pipe.
1,038 ft., 12-inch, 15-inch and 20-inch pipe.
1,989 ft., 12-inch, 15-inch, 18-inch and 20-inch pipe.
1,182 ft., 12-inch, 15-inch and 27-inch pipe.
2,385 ft., 12-inch, 15-inch, 18-inch and 27-inch pipe.
Escanaba: Sewer system and disposal plant, $120,000.
Grand Rapids: Sewer extensions, $80,000.
Granville: No work laid out; use vitrified pipe in all sewers.
Highland Park: Not determined as yet.
Hillsdale: Vitrified pipe, about 2,500 ft. 8-inch and 12-inch.
Holland: Vitrified pipe, 1 mile.
Iron Mountain: Reinforced concrete, 1,650 ft. of 48-inch.
Iron pipe, 1,650 ft. of 12-inch diam.
Saginaw: Plain concrete, 1 mile.
Reinforced concrete pumping stations.
Vitrified pipe, 3 miles.

MINNESOTA.

Albert Lea: Vitrified pipe, 1,500 ft. 10-inch. 9,700 ft. 8-inch.
Bemidji: Some short branches.
Faribault: Vitrified pipe, 5,425 ft. 8-inch.
660 ft. 9-inch.
410 ft. 10-inch.
870 ft. 24-inch.
Fergus Falls: Vitrified pipe, 1,000 ft. 15-inch; 900 ft. 12-inch; 700 ft. 8-inch.
Mankato: Reinforced concrete, 1,700 ft.
Vitrified pipe, 2,000 ft.
Minneapolis: Vitrified pipe, 20 miles.
Montevideo: Vitrified pipe, 1,200 ft. of 8-inch.
St. Paul: Extensions, $300,000.
Stillwater: Vitrified pipe, 2,000 ft. 6-inch to 24-inch.
Vitrified segment, 2,200 ft. of 30-inch to 36-inch.
Winona: Vitrified pipe, 1½ miles, 8, 12, 15, 20 and 24-inch.

MISSISSIPPI.

Clarksdale: Vitrified pipe, 850 ft. 24-inch. 300 ft. 15-inch.
Hattiesburg: Vitrified pipe, 1,500 lin. ft. 8-inch.
Vicksburg: Branches, local sewers.

MISSOURI.

Eldorado Springs: Branch sewers.
Hannibal: Plain concrete, 2 miles.
Reinforced concrete, 1,000 ft.
Vitrified pipe, 112,400 lin. ft.
Jefferson City: Vitrified pipe, 5 miles 8-inch; 3 miles 6-inch.
Kansas City: About 45 miles contemplated; sizes from 8-inch to 6-feet; materials admitted by specifications. Cost, $800,000.
Kirksville: Vitrified pipe laterals, 4,000 ft.
Liberty: Vitrified pipe, 500 ft. 8-inch.
Nevada: Vitrified pipe, 4,000 lin. ft.
Poplar Bluff: Vitrified pipe, 1 mile, 18-inch to 6-inch.
Sedalia: Brick, 1½ miles egg shape contemplated.
Vitrified pipe, 15 miles.
Springfield: Vitrified pipe, 5 miles, 12, 10 and 8-inch.
Webb City: Plain concrete, 200 ft.
Vitrified pipe, 4,000 ft.

MONTANA.

Bozeman: Vitrified pipe branch sewers.
Dillon: Vitrified pipe, 12,000 lin. ft. 8-inch to 24-inch.
Great Falls: Reinforced concrete, 3,000 ft., 4-foot circular.
Vitrified pipe, 1½ miles 9-inch.
Helena: Vitrified pipe, 2,500 lin. ft. 8 and 10-inch.
Lewistown: Vitrified pipe, 6,000 ft. lateral.

NEBRASKA.

Lincoln: Vitrified pipe, about 1½ miles of 8-inch.
Norfolk: Vitrified pipe, 2,500 ft. 8-inch to 18-inch.
University Place: Vitrified pipe, 1 mile.

NEVADA.

Reno: Vitrified pipe, 1 mile.

NEW HAMPSHIRE.

Laconia: Small pipe branches.
Littleton: Vitrified pipe, 500 ft. 10-inch.

NEW JERSEY.

Bayonne: $10,000.
Beach Haven: Vitrified pipe, 1 mile main to ejectors; cost $21,000.
Elizabeth: $30,000 sewerage system will be constructed.
Ocean City: Vitrified pipe, 4,000 lin. ft.
Plainfield: Vitrified pipe, 1 mile, besides present contract.
Ridgewood: Plain concrete, 2,450 ft. 42-inch.
Reinforced concrete, 2,500 ft. 6-foot by 2½-foot.
Vitrified pipe, 1,500 ft. 24-inch; 1,200 ft. 6-inch and 8-inch; 3,350 ft. 6-inch c. i. pipe.
Rutherford: Vitrified pipe, 1 mile, 8-inch and 24-inch.

South Orange: Reinforced concrete, 500 lin. ft. 8-foot by 4-foot, storm sewer.
Trenton: (Sewer data later).
Westfield: Vitrified pipe, 2 miles.
West New York: Vitrified pipe, 2,000 ft. 12-inch.

NEW MEXICO.

Albuquerque: Pipe laterals.

NEW YORK.

Binghamton: Reinforced concrete, 2 miles 30-inch (under contract), lock joint.
Vitrified pipe, 4 miles, 8-inch to 18-inch.
Cortland: Vitrified pipe, 1 mile.
Elmira: Vitrified pipe, 3,000 ft.
Ilion: Treatment works, $35,000.
Jamestown: Expenditure of $25,000 proposed.
Niagara Falls: Reinforced concrete, 1 mile.
Vitrified pipe, 2 miles.
Norwich: Vitrified pipe, 3,500 ft. 8 and 10-inch.
Reinforcing, 1,800 ft. 8-inch cracked longitudinally along crown and sides.
Ogdensburg: No sewers ordered yet.
Oswego: Reinforced concrete, 5,700 ft. 5-foot to 6-foot.
Vitrified pipe, 23,000 ft. 8-inch to 39-inch.
Imhoff disposal tank.
Rochester: Sewage disposal plant will be let this year.
Schenectady: Reinforced concrete, 2 miles.
Vitrified pipe, 6 miles.
Syracuse: Vitrified pipe, 5 miles.
Troy: Brick, 1,500 ft. 36-inch by 48-inch.
Reinforced concrete, 1,900 ft., 8-foot.
Vitrified pipe, 10,000 ft. 8-inch to 24-inch.
Watertown: Reinforced concrete, 1 mile; contract let.
Vitrified pipe, 2 miles.

NORTH CAROLINA.

Greensboro: Vitrified pipe, 6,000 ft.
Rocky Mount: Vitrified pipe, to cost about $40,000.
Wilmington: Vitrified pipe, 36 miles, sanitary, 8-inch to 24-inch; contract awarded.

NORTH DAKOTA.

Bismarck: Vitrified pipe, 3,000 ft. 8-inch.
Dickinson: Short pipe laterals.
Minot: Vitrified pipe, 2 miles.
Valley City: Proposes to spend about $75,000 on sewers.
Williston: Vitrified pipe, 6,420 ft.

OHIO.

Barberton: Vitrified pipe, 10 miles.
Bowling Green: Reinforced concrete, 2,000 ft. 40-inch.
Vitrified pipe, 8,000 ft. 18-inch; 2,000 ft. 10-inch; 1,000 ft. 8-inch.
Cambridge: Vitrified pipe, 7,000 ft. of 8, 10 and 12-inch, on concrete base.
Canton: Brick, ½ mile 7-foot, 2 ring block; 2 miles 36-inch 1 ring.
Vitrified pipe, 7 miles.
Sewage disposal, $150,000.
Celina: A complete sanitary sewer system will be sold as soon as proper legislation is passed; estimate, $80,000.
Chillicothe: Reinforced concrete, 3,280 lin. ft. 7-foot by 10-foot.
Vitrified pipe, 1,250 lin. ft.
Conneaut: Vitrified pipe, 4,500 lin. ft.
Delaware: Sewer mains, $15,000.
Sewage disposal, $25,000.
Fostoria: Vitrified pipe, 900 ft.
Sewage disposal plant.
Lorain: Vitrified pipe, 2 miles.
Mansfield: Sewer extensions, $20,000.
Massillon: 3,000 ft. storm, 2,000 ft. sanisewers.
Newark: Vitrified pipe, 14,000 lin. ft.
Niles: Vitrified pipe, 5,000 lin. ft. 6-inch to 10-inch.
Oberlin: Small pipe extensions.
Ravenna: Vitrified pipe, 5,280 ft.
Sanitary sewage disposal plant enlarged.
Salem: Storm sewer, 8,200 ft. long, 36-inch pipe to 5½ by 7 concrete box. Brick.
Vitrified pipe, about 1,000 ft.; sanitary sewers, 8-inch.
Springfield: Vitrified pipe, 3 miles 8-inch to 24-inch.
Steubenville: Vitrified pipe, 1 mile 12-inch to 15-inch.
Tiffin: Vitrified pipe, 550 ft.
Warren: Extensions, $10,000.
Wellsville: Vitrified pipe, 1,000 ft.
Wooster: Vitrified pipe, 20,000 lin. ft., 15, 12, 10, 8 and 6-inch.
Zanesville: Vitrified pipe, 5,000 ft. 12-inch; 4,000 ft. 18-inch.

OKLAHOMA.

Durant: Small pipe branches.
El Reno: Sewer extensions, $20,000.
McAlester: Vitrified pipe, 700 ft. 6-inch.
Okmulgee: Sewer extensions.
Tulsa: Sewer system costing about $100,000.

OREGON.

Coquille: Vitrified pipe, 39,000 lin. ft., 4, 6, 8, 10, 12-inch.
Brick manholes, flush tanks, concrete inverts.
Eugene: Plain or reinforced concrete, 16,000 lin. ft., 8 to 12-inch.
Grant's Pass: $15,000.

PENNSYLVANIA.

Athens: Vitrified pipe, about 3,300 ft. 12-inch to 24-inch.
Dravosburg: Vitrified pipe, 800 lin. ft. 18-inch.
DuBois: Vitrified pipe, 3,000 ft. 8-inch.
2,000 ft. 15-inch.
Erie: Plain concrete, 2,000 ft. 40-inch.
Vitrified pipe, 13,000 ft. 9, 12 and 15-inch.
Farrell: Vitrified pipe, under consideration.
Engineer retained for sewage disposal plans.
Hanover: Reinforced concrete, 720 ft. 3-foot by 4-foot, rectangular.
Vitrified pipe, 2,200 lin. ft. 24-inch.
Harrisburg: Reinforced concrete, 21,300 ft.
Vitrified pipe, 21,300 ft.
McKeesport: Sewer extensions, $12,000.
McKees Rocks: Vitrified pipe, 2,500 ft. 8-inch to 15-inch.
Meadville: Small pipe laterals.
Monongahela City: Vitrified pipe, 2,900 lin. ft. 24-inch; 240 lin. ft. 18-inch; 1,200 lin. ft. 12-inch.
New Brighton: Vitrified pipe, 24-inch.
New Castle: Vitrified pipe, 1 mile small contracts.
Northeast: Sewage disposal, $10,000.
Philadelphia: Appropriations to the extent of $850,000 will be available; details of construction not determined as yet.
Ridgway: Vitrified pipe, 2,000 ft. 12-inch.
Sayre: Vitrified pipe, 2,000 ft. of 8-inch to 12-inch.
Sharpsville: Not determined.
Swissvale: Vitrified pipe, 1,300 lin. ft. 10-inch.
Titusville: Vitrified pipe, 1½ miles, small diameter.
Wilkes-Barre: Considerable additions to and changes in sewerage system, costing perhaps $100,000.
York: Brick, plain concrete, reinforced concrete or vitrified pipe, 10 miles.

RHODE ISLAND.

Woonsocket: Vitrified pipe, about ½ mile.

SOUTH DAKOTA.

Aberdeen: Sewage pumping and disposal plant, $35,000.
Mitchell: Short pipe laterals.
Sioux Falls: Vitrified pipe, 10 miles.

TENNESSEE.

Columbia: Vitrified pipe, 1,700 ft.
Jackson: Brick, 98,000 ft.
Vitrified pipe, 23,000 lin. ft.
Memphis: Vitrified pipe, 10 miles.

TEXAS.

Bryan: Branches.
El Paso: Sewer system under way, to cost about $150,000.
Lufkin: A fifty-year franchise granted to install a system of sanitary sewers 9 miles in length; sewage to be treated in septic tanks.
Paris: Vitrified pipe, 20,000 ft. 10-inch to 6-inch.
Waxahachie: Vitrified pipe, 2½ miles.

UTAH.

Ogden: Plain concrete, 2,953 lin. ft.
Vitrified pipe, 7,529 lin. ft.
Salt Lake City: Vitrified pipe, 31,120 ft. 8-inch; 6,925 ft. 10-inch; 2,327 ft. 12-inch.

VERMONT.

Bellows Falls: Plain concrete, 1,300 ft. 32-inch by 48-inch.
Vitrified pipe, 1,500 ft. 12-inch to 24-inch.

VIRGINIA.

Danville: Vitrified pipe, 10,000 feet of 8-inch and 10-inch.

WASHINGTON.

Aberdeen: Reinforced concrete, 1,460 ft. 42-inch; 728 ft. 36-inch; 1,700 ft. 33-inch; 1,085 ft. 30-inch.
Vitrified pipe or reinforced concrete, 20,000 ft. 6, 8, 10, 12 and 18-inch.
Hoquiam: Vitrified pipe, 18,000 ft. 6-inch; 12,000 ft. 8-inch; 2,000 ft. 10-inch; contract awarded.
Seattle: Reinforced concrete, 2,600 lin. ft.
Vitrified pipe, 200,000 lin. ft.
Tacoma: Sanitary and storm, $150,000.
Walla Walla: Vitrified pipe, 10,000 lin. ft. sizes.

WEST VIRGINIA.

Parkersburg: Reinforced concrete, 6,000 ft.
Vitrified pipe, 4,000 ft.

WISCONSIN.

Baraboo: Small branches only.
Eau Claire: Tenth Ward sewer, 4,300 ft.
800 ft. of 30 to 36-inch sewer.
1,400 ft. of 8 to 15-inch sewer.
Kenosha: Sewer extensions, $30,000.
Madison: Vitrified pipe, 25,000 ft. of all sizes.
Marinette: Brick, 4,000 lin. ft., 3-foot.
Vitrified pipe, 2,000 lin. ft.
Oshkosh: Reinforced concrete, 1,200 ft. 30-inch; 600 ft. 10-foot by 4.5-foot; cost $6,000.
Vitrified pipe, 2,700 ft. 27-inch, 15-inch, 12-inch.
Appropriation for new sewer construction, $20,470, and for catch-basins, $2,000.
Sheboygan: Vitrified pipe, 3,000 ft. 10-inch to 20-inch.
Two Rivers: Small pipe laterals.
Waukesha: Vitrified pipe, 9,000 ft.
Waupaca: Vitrified pipe, 4,000 ft. 8-inch and 18-inch.

CANADA.

Chatham, Ontario: Vitrified pipe, 5,000 ft.
Guelph, Ontario: Vitrified pipe, 12,200 ft.
Hamilton, Ontario: Plain concrete, 1 mile 30-inch to 48-inch.
Vitrified pipe, 3 miles 12-inch to 24-inch.
Lethbridge, Alberta: Vitrified pipe, 1½ miles sanitary.
Concrete, brick or segment block, ½ mile storm.
London, Ontario: Not decided whether to adopt storm sewer system; if adopted will cost $89,000.
Ottawa, Ontario: Brick; two systems nearly completed now.
Vitrified pipe, 3 miles.
Prince Rupert, B. C.: Two outfalls and trunk sewer; estimated cost, $450,000.
Regina, Sask.: Vitrified pipe, 25 miles 8-inch to 48-inch.
Vancouver, B. C.: Not yet outlined.

NOVA SCOTIA.

Halifax: Plain concrete, 1 mile of 48-inch; 1 mile of 18-inch to 24-inch.

WATER WORKS IMPROVEMENTS FOR 1913

ALABAMA.

Dothan: $70,000 combined water and power plant under construction.
Gadsden: Will spend $1,000 for meters.
Troy: Extensions of mains, $28,000.

CALIFORNIA.

Burlingame: Election called for $175,000 bonds for water works.
Gilroy: Water works; new reservoir.
Glendale: Will vote on water works construction this spring.
Huntington Beach: City may purchase local water works.
Imperial: Two miles cast iron mains.
Oxnard: Have voted $130,000 bonds for water and light system.
Pasadena: Voted last year, $1,125,000 for water works.
Redlands: Has purchased water works and will make extensions.
Santa Ana: Begun on 8,500,000-gal. reservoir.
Sierra Madre: City is purchasing water company and contemplates improvements; expenditure, $171,000.
Tulare: Has just voted $100,000 bonds for water works.

COLORADO.

Grand Junction: Short extensions of mains.

CONNECTICUT.

Southington: Water works, 5,000 ft. to 10,000 ft. 2-inch mains.
Torrington: Water works; private concern will do a good deal of work.
Wallingford: Water works, 3,500 lin. ft. 6-inch to 8-inch.

FLORIDA.

Dade City: Water works, $15,000 franchise contemplated.
Sarasota: $30,000 on plant and mains.

GEORGIA.

Americus: Will buy some meters.
Lagrange: A new $150,000 plant.
Moultrie: Will buy a few meters.

IDAHO.

Weiser: 500,000-gal. reinforced concrete reservoir.

ILLINOIS.

Assumption: 60,000 ft. gal. pipe let and

under construction; distribution let and partly constructed.
Bloomington: Main extensions, $50,000.
Canton: Water works, 3,000 ft. 6-inch iron pipe; 2,500 ft. 4-inch cast iron pipe; fittings for 1½ million gal. pump.
Chicago Heights: Water works, 3,000 lin. ft. 14-inch main.
Elgin: Water works, stand pipe.
Lake Forest: Short extensions of mains.
Mattoon: 1 mile 6-inch water pipe.
Moline: $100,000 improvements.
Normal: Water works, cost $15,000, some small extensions.
Oak Park, Village of: Water works, 2¼ miles 6-inch and 8-inch water pipe; 404 lead water service pipes, ¾-inch diam.
Quincy: Water works, new filter plant.
Rockford: Water works, new mains $30,000.
Rock Island: Extensions, $70,000.
Waukegan: Extension of intake.
Wood River: Water works; 2,600 ft. of 6-inch main; 600 ft. of 8-inch main.

INDIANA.

Connersville: New pumps are needed.
Evansville: Main extensions $40,000.
Fort Wayne: 2 miles, 4-inch to 8-inch.
Huntington: New wells and pump.
Logansport: Short extensions of mains.
Plymouth: Short branches.
Portland: Few extensions.

IOWA.

Cedar Falls: Some short extensions of mains and additional meters.
Dubuque: Water works, $75,000; reservoir and new machinery.
Independence: 1 mile 6-inch mains.
Indianola: Small amount of work to be done.
Marshalltown: Water and sewer extensions, $25,000.
Muscatine: Extensions of mains, $35,000. Reservoir work, $25,000.
Nevada: Water works, pump house and several blocks 6-inch mains.
Oskaloosa: Water works, 2 miles of service extensions.

KANSAS.

Belleville: A little work only.
Fort Scott: A few main extensions and work on reservoir.
Manhattan: Extension of mains, $10,000. A few additional meters.
McPherson: I new well and pump.
Osawatomie: Some meters and pumping station renewals.
Salina: Water works, may come up this year, but is not settled.
Topeka: Main extensions, $17,000. New meters, $2,500. Reservoir, $15,000.

KENTUCKY.

Ashland: Water works, in court.
Louisville: Main extensions in progress, $300,000. Pumping plant additions, $20,000.

LOUISIANA.

New Orleans: Water works; small extensions to outlying sections.

MAINE.

Lewiston: Water works, usual extension.
Pittsfield: Small extensions of mains.

MARYLAND.

Baltimore: Reservoir construction amounting to $2,500,000 in progress.

MASSACHUSETTS.

Great Barrington: Water works; the South Egremont Water Co., South Egremont, Mass., will, as soon as spring opens, build a concrete reservoir dam and lay about 19,000 ft. of cast iron water mains; bids are asked for.
Lowell: Extensions of mains, $50,000. New meters, $10,000.
Westfield: Water works; preliminary work for large storage reservoir.

MICHIGAN.

Grand Rapids: Extensions of mains, $35,000; new meters, $10,000.
Granville: Water works; may be some small extensions of water mains during summer.
Hastings: Two new 2,000,000 gal. pumps.
Hillsdale: Some extensions of mains.
Holland: Water works, under consideration.
Saginaw: Water works, new.

MINNESOTA.

Albert Lea: Two miles 4-inch and 6-inch.
Bemidji: Some new construction, $7,000.
Faribault: Water works, 3,000,000-gallon reservoir; 3,000 ft. pipe.
Fergus Falls: Water works, 2,000 ft. 6-inch and 4-inch; 2,600 ft. 18-inch.
Mankato: Water works, light motor truck.
Minneapolis: Extensions of mains, $150,000.
Monterideo: Short extensions and a few meters.
St. Paul: Extensions, $500,000.
South St. Paul: Main extensions, $7,000.
Stillwater: Probably ½ to 1 mile.

MISSISSIPPI.

Port Gibson: Small main extensions.
Vicksburg: Main extensions, $8,000.

MISSOURI.

Eldorado Springs: Some main extensions, small.
Fulton: 2,000 ft. of 4-inch mains.
Hannibal: Water works, $200,000, private corporation.
Kansas City: Addition to distribution system, $300,000. Additions to pumping plant, $125,000.
Kirkville: Will buy a few meters.
Liberty: Reservoir construction, $9,000.

MONTANA.

Bozeman: A few extensions of mains.
Great Falls: Water works, $50,000.

NEBRASKA.

Lincoln: Water works, 4½ miles.
Norfolk: New boilers and wells.
Tecumseh: A few main extensions.
University Place: Water works, new mains.

NEW JERSEY.

Bayonne: New pipe, $10,000.
Ocean City: Water works, additions, 4,000 ft. cast iron mains.
Rutherford: Water works, stand pipe storage being agitated, for additional pressure.

NEW YORK.

Cortland: Water works, new mains.
Jamestown: New mains, $150,000. Meters, $10,000. Additions to pumping plant, $50,000.
Niagara Falls: Main extensions, $25,000.
Rochester: Water works; ordinary amount of water pipe extension and some enlargements of existing mains, amounting to about $100,000.
Syracuse: New mains, $35,000. Meters, etc., $20,000.
Watertown: Water works; dam and canal.

NORTH CAROLINA.

Greensboro: Water works, $10,000.
Raleigh: Water works; city will vote on bond issue for $400,000 for plant.

NORTH DAKOTA.

Bismarck: Water works, private corporation.
Dickinson: A few main extensions.
Minot: Water works, 2 miles water mains.
Valley City: A few new mains and meters.
Williston: Water works, one 250,000 gal. stand pipe; 10,000 ft. cast iron pipe.

OHIO.

Bowling Green: A few new mains and meters.
Cambridge: Water works, extension water mains, estimate $5,000, 4-inch and 6-inch cast iron lines.
Canton: Main extensions, $58,000.
A few new meters.
Fostoria: Water works, one 100,000,000 gal. reservoir.
Oberlin: Small additions to mains and pumping plants.
Ravenna: Water works, 12 miles pipe.
Steubenville: Filtration plant.
Zanesville: New well system, $363,000.

OKLAHOMA.

Chandler: Small additions to mains and meters.
Clinton: Will purchase some meters.
Durant: Small main extensions.
El Reno: A few new mains and meters.
Okmulgee: Will spend about $20,000 on reservoir; new mains, meters, etc.
Tulsa: Main extensions and meters, $40,000.

OREGON.

Coquille: Relaying 4,000 ft. 4 and 6-in. pipe for 100 lbs. pressure.
Eugene: $100,000 in mains.
McMinnville: Some new mains.

PENNSYLVANIA.

Dubois: Will spend about $10,000 on main extensions, meters and reservoir.
Farrell: Water works, to be voted on April 8, 1913.
Ridgway: Water works, 4,000 ft. 8-inch water line.

SOUTH CAROLINA.

Columbia: Water works; contract awarded for coagulation basin, $30,000.

SOUTH DAKOTA.

Aberdeen: Pumping plant additions, $7,500.
Mitchell: Short main extensions.

TENNESSEE.

Memphis: Ordinary extensions.

TEXAS.

Bryan: A few additions to mains and meters.
Paris: Water works, 5 miles mains and new pump plant, cost $30,000.

UTAH.

Ogden: Will spend $100,000 on reservoirs and $25,000 on extensions of mains.

WASHINGTON.

Aberdeen: Five mi. wood stave pipe and dam.
Grandview: Water works; will complete a $16,000 system in March, 1913.
Seattle: 50,000 lin. ft. c. i. water mains.

WISCONSIN.

Appleton: Pumping plant, etc., $100,000.
Baraboo: A few main extensions and meters.
Eau Claire: 8,000 ft. of 6-inch main.
Kenosha: Extensions of mains, $15,000.
A few meters.
Madison: 15,000 ft. of new mains.
Oshkosh: Water works, city to buy.
Sheboygan: 3½ miles extension of mains.
Waukesha: New mains, $10,000 and a few meters.
Waupaca: 1,000 ft. small mains.

CANADA.

Chatham, Ont.: Extension to filters.
Hamilton, Ont.: Water works mains, 6 miles.
Lethbridge, Alberta: Water works, 5 miles metal pipe, 4-inch to 24-inch diam.
Ottawa, Ont.: Sedimentation basis for temporary supply; surveys going ahead for new supply from lakes.
Prince Rupert, B. C.: Water works and hydro-electric plant, $300,000.

NOVA SCOTIA.

Halifax: Water works, 3,000,000 gal. reinforced concrete reservoir, and 3 miles of distribution 12-inch to 20-inch.

STREET LIGHTING FOR 1913

CALIFORNIA.

Alhambra: Six miles of ornamental lighting.
Hanford: Will vote $20,000 bonds for power system.
Huntington Beach: 35 new ornamental concrete 3-light posts just put in; more to follow.
Making plans for gas plant to build this year.
Oxnard: Has voted $130,000 bonds for water and light system.
Palo Alto: Small improvements.
Pasadena: Ornamental lighting, 6 miles.

CONNECTICUT.

Torrington: Business section will have better lights.

DISTRICT OF COLUMBIA.

Washington: Lighting, $391,000.

FLORIDA.

Dade City, Lighting installed.

ILLINOIS.

Centralia: Lighting; possibly ornamental on 7 blocks.
DeKalb: Lighting, 6 blocks White Way.

INDIANA.

Anderson: 2,000-kilowatt generator.
Fort Wayne: Lighting; one mile of street with ornamental lamp posts.
Huntington: Lighting; new dynamo
Richmond: Lighting; addition to power house and new unit installed.

IOWA.

Dubuque: Lighting; $285,000.
Independence: Lighting, not known.

KANSAS.

Paola: $45,000 plant.
Pittsburg: Lighting, 5 blocks White Way.
Wichita: Lighting, 1 mile White Way.

KENTUCKY.

Ashland: Lighting; Ohio Valley Elec. Co. will probably renew franchise.

March, 1913.

MASSACHUSETTS.

Southbridge: Lighting, ornamental.

MICHIGAN.

Hastings: 500-kilowatt lighting plant.
Holland: Lighting, under consideration.
Saginaw: Lighting; new system.

MISSOURI.

Kansas City: Lighting; municipal electric plant talked of, but no bonds voted yet; up for consideration this spring.
Sedalia: Lighting and gas, $150,000; betterments.
Webb City: Lighting; to improve system.

MONTANA.

Great Falls: Lighting, $15,000.
Helena: 500 single lamp posts.
137 5-lamp posts in business district.

NEBRASKA.

University Place: Lighting; new plant.

NEW JERSEY.

Ocean City: Lighting; new system for boardwalk.
Plainfield: Lighting; improvements planned.

NEW YORK.

Binghamton: Lighting; new municipal electric light plant, cost $158,000, street lighting only; 300 k. w. extension of boulevard lighting system to cost $74,000.
Ilion: Lighting; $25,000 for new unit to be submitted to taxpayers March 4.
Niagara Falls: Lighting; $30,000 on decorative street illumination.
Troy: Lighting; Tungsten lighting system, 306 standards, 1 upright, 4 pendants.

NORTH CAROLINA.

Rocky Mount: Municipal gas works to cost $70,000.

NORTH DAKOTA.

Minot: Lighting; ornamental lighting system, 10 blocks.
Williston: Lighting; 56 White posts.

OHIO.

Barberton: Lighting plant.
Bryan: Lighting; arrangements will be made soon for advertising for a system of fine light ornamental standard lighting system for court square and the business section of our city; about 70 ornamental posts will be needed.
Toledo: Lighting; city is looking forward to municipal ownership of Toledo, Railway and Light companies. It includes a street railway, lighting system, heating and amusement properties.
Wellsville: Lighting; municipal light plant.

OREGON.

Eugene: Some cluster lights.

PENNSYLVANIA.

Dravosburg: New 5-year contract.
Farrell: Lighting; under consideration.
Titusville: Installing new generators now.

TENNESSEE.

Jackson: Lighting; Great White Way.
Memphis: Lighting; ordinary extensions.

TEXAS.

Paris: Lighting; 20 additional arcs.
Waxahachie: Lighting; whole town.

WEST VIRGINIA.

Parkersburg: Lighting; contracted for.

WISCONSIN.

Eau Claire: Lighting; system remodeled and White Way on Main street.

CANADA.

Chatham, Ontario: Extension to street lighting.
Hamilton, Ontario: Complete new system.
London, Ontario: Lighting, 300 additional.
Prince Rupert, B. C.: Hydro-electric plant and water works, $300,000.

BRIDGES AND BUILDINGS FOR 1913

ALABAMA.

Gadsden: Three bridges.
Jasper: One bridge probably.

CALIFORNIA.

Alhambra: 2 bridges, approximate cost, $4,000.
City hall bonds voted, $50,000.
Library bonds voted, $50,000.
Bridge bonds voted, $32,000.
Huntington Beach: 1,300 ft. concrete wharf; bids to be opened in March; $65,000.
San Bernardino: Contemplating $75,000 city hall.
San Francisco: Raising $800,000 for municipal auditorium.
City hall, $4,000,000.
Public library building, $1,000,000.
Santa Ana: Technical high school, $225,000 bonds voted.
Santa Barbara: Contract let, $35,000.
Vallejo: City hall, $75,000.

CONNECTICUT.

Middletown: One span about 80 ft.
Southington: One iron bridge with reinforced concrete floor.
Torrington: Two steel bridges.

DISTRICT OF COLUMBIA.

Washington: Bridges to cost $435,000.

ILLINOIS.

Dixon: Bridges and culverts, 1,500 cu. yds. concrete.
Edwardsville: One bridge.
Lake Forest: One concrete bridge.
Moline: Concrete bridge, 100 ft. span.
Rockford: One concrete bridge, $2,200.
One concrete bridge, $2,700.
Streator: One bridge to be repaired (concrete to be used).
Waukegan: Reinforced concrete arch, $70,000.

INDIANA.

Connersville: 7 bridges, $6,500.
Covington: Four small bridges.
Crawfordsville: Repair 2 bridges, concrete floors.
Hartford City: 7 concrete bridges.

IOWA.

Clinton: Concrete bridge, $2,000.
Marshalltown: County concrete bridges, $25,000.

KANSAS.

Newton: One concrete bridge, cost $6,000.
Paola: 3 concrete culverts.
Pittsburg: Three concrete bridges; total, $3,000.
Salina: Cement bridge.

MASSACHUSETTS.

Southbridge: Three cement concrete girders.

MICHIGAN.

Granville: Nothing except replacing bridges.
Building an expensive school house.
Hillsdale: One small cement bridge.
Saginaw: Market house.

MINNESOTA.

Albert Lea: One 60-foot steel bridge.
Faribault: One viaduct 988 ft., steel.
Minneapolis: Two bridges across Mississippi river.
Montevideo: 60 ft. concrete bridge and spillway, and 100 ft. timber foot bridge.
Stillwater: One bridge; type not decided.
Winona: 30 ft. concrete girder.

MISSOURI.

Fulton: $3,500 reinforced concrete 65-foot arch, 26 feet wide.
Jefferson City: Two concrete bridges; one concrete tunnel.
Kansas City: Twelfth street trafficway (reinforced concrete), $650,000.
Springfield: Concrete waterways, about $7,000.

MONTANA.

Great Falls: Concrete arch 1,000 ft. long.

NEW JERSEY.

Ocean City: One bridge, $192,000.

NEW YORK.

Binghamton: One 60-foot span, reinforced concrete.
New high school, $375,000.
Cortland: One bridge.
Elmira: One small reinforced concrete bridge; reinforced concrete retaining wall for 2 approaches.
Ilion: High school building, $100,000 (advertised).
Rochester: Reinforced conduit to carry waters of Canadice lake into Hemlock lake.
Syracuse: Three bridges.
Watertown: Bridge 1,000 ft. long to be voted on about June 1.

NORTH DAKOTA.

Minot: Two-foot bridges; one highway bridge.

OHIO.

Canton: One stone arch; one steel arch.
Conneaut: One bridge, street railway and highway.
Massillon: One 2-span river bridge.
One 1-span canal bridge.
Niles: One bridge.
Steubenville: One bridge.

OKLAHOMA.

McAlester: One reinforced concrete bridge.

OREGON.

Coquille: 1,300 lin. ft. 24-foot elevated roadway on pile footings.
1,200 lin. ft. reinforced concrete elevated roadways to replace old structures 60 ft. wide, 10 to 22 ft. high. Information wanted on materials for reinforcement of concrete roadway, slab system.

PENNSYLVANIA.

Athens: Bridge over Susquehanna river by Bradford Co. to replace old one, estimated about $60,000.
Catasauqua: Two reinforced concrete bridges.
DuBois: Bridges, 80-foot span and 20-foot span.
Eugene: Two concrete bridges, 60-ft. span, 66 ft. wide.
Farrell: One bridge.
Philadelphia: Bridges; $200,000 appropriation; details not determined as yet.
Ridgway: Reinforced concrete bridge, 70-foot span, 20-foot roadway, with two 5½-foot walks; contract let; $7,000.
Titusville: One small concrete bridge.
York: One 150-foot span, reinforced concrete.

RHODE ISLAND.

East Providence: Re-planking Washington bridge, 500 ft.
Woonsocket: One arch 60-foot span, 32-foot roadway, 50 feet wide over all.

TENNESSEE.

Memphis: Chicago and Rock Island Railroad, wagon and street railway bridge, over Mississippi river.

UTAH.

Ogden: One steel bridge.

VIRGINIA.

Danville: Appropriations not yet made.
Newport News: Repairs, about $4,000, to be done by county, railway and city jointly with own forces.

WASHINGTON.

Aberdeen: Single-leaf steel bascule bridge.

WISCONSIN.

Eau Claire: Bridges; reinforced concrete arch bridge about 700 ft. long.
Madison: One reinforced arch.
Oshkosh: The following appropriations made for public improvements:
$3,500 for concrete bathing pavilion at Menominee Park.
$500 for laboratory for city health department.
$650 for branch library on south side.
$2,200 for industrial and continuation schools.
$400 for repairing bridge in Menominee park.
$400 for display fountain in Riverside park.
$1,200 to construct dock at foot of Court street, and $750 for dock at foot of Nebraska street.
Bridge at West Algoma street, $186,-612.82. Contract let.
Sheboygan: One 2-span highway, $20,000.

CANADA.

Chatham, Ontario: Three bridges.
Guelph, Ontario: Hefferman street bridge, 518 ft. long.
Victoria bridge, 200 ft. long.
Hamilton, Ontario: 3 steel trestles; 2 wooden trestles.
London, Ontario: 1 highway bridge, 3 130-ft. spans over River Thames.
Ottawa, Ontario: Bronson avenue viaduct (steel).
Pretoria avenue bridge (reinforced concrete).
Regina, Sask.: Bridges, $35,000.

MISCELLANEOUS IMPROVEMENTS FOR 1913

Garbage Disposal

CALIFORNIA.

Alhambra: $10,000 voted for incinerator.
Berkeley: Plans ready for incineration plant.
Pasadena: Incinerator under construction.

CANADA.

Chatham, Ontario: Commencing regular collection.
Hamilton, Ontario: $46,000.
London, Ontario: Incinerator, 50 tons per day, being erected.
Ottawa, Ontario: New system, city takes over all equipment, $130,000 to be spent.

DISTRICT OF COLUMBIA.

Washington: $180,000.

ILLINOIS.

Chicago Heights: Incinerating plant.

IOWA.

Dubuque: $6,000.
Oskaloosa: Garbage to be collected this year.
Toledo: Outlet and disposal plant, cost $7,000. Bids called for March 10.

KANSAS.

Arkansas City: Contract to be let for garbage in few days.

MASSACHUSETTS.

Southbridge: Garbage collection, yes.

MICHIGAN.

Highland Park: Under consideration.

MINNESOTA.

St. Paul: Incinerator to be built, $200,000.

MISSOURI.

Hannibal: $6,000.
Kansas City: One destructor to be built, cost $50,000.

MONTANA.

Great Falls: 11,000 loads.

NEBRASKA.

Lincoln: Plant contemplated.

NEW JERSEY.

Plainfield: Talked of.

NEW YORK.

Schenectady: One plant.

NORTH CAROLINA.

Wilmington: Decarie incinerator, 40 tons' capacity.

OHIO.

Ravenna: Possible collection and disposal contract for 5 years.
Massillon: Wanted.

OREGON.

Coquille: Information wanted about installing municipal plant.

PENNSYLVANIA.

Dravosburg: In prospect.
Erie: $35,000.

TENNESSEE.

Memphis: About 100 tons per day.

WASHINGTON.

Aberdeen: Let by contract.

WEST VIRGINIA.

Parkersburg: Contracted for.

Street Signs

CALIFORNIA.

Lodi: About 300.

FLORIDA.

Dade City: 200 contemplated.

ILLINOIS.

Quincy: Perhaps 1,600.

INDIANA.

Huntington: Some.
Nevada: In preparation for establishment of free delivery of mail.

MASSACHUSETTS.

Westfield: About 30 new signs.

MICHIGAN.

Highland Park: Under consideration.

NEW JERSEY.

Ocean City: Few wanted.
Plainfield: All ordered, 125.

NORTH DAKOTA.

Minot: 500.

OHIO.

Massillon: Repair.
Ravenna: 300 double signs.

PENNSYLVANIA.

Harrisburg: 3,900.

WASHINGTON.

Aberdeen: 3,000.

CANADA.

Lethbridge, Alberta: $300.

Fire Departments

ALABAMA.

Dothan: $9,000 auto fire truck and engine.

CALIFORNIA.

Alhambra: $31,000.
Berkeley: Asked bids for $5,000 extension to police signal and alarm system.
Gilroy: New chemical motor.
Huntington Beach: New combination auto chemical and hose cart.
Lodi: One combination auto truck.
Palo Alto: Small improvements.
Tulare: Just voted $8,000 for new fire apparatus and $2,000 for fire alarm system.
Vallejo: $35,000.

CONNECTICUT.

Ansonia: New alarm system.

ILLINOIS.

Canton: Purchase of motor truck.
Chicago Heights: Hook and ladder equipment and hose.

INDIANA.

Anderson: 1 ladder truck; 1 auto chemical for chief.
Bloomington: Fire department and city building, $25,000.
Fort Wayne: Motor equipment one department.
Huntington: New central station.
Indianapolis: New fire department headquarters building.

IOWA.

Dubuque: Auto pumping engine, $10,000.
Marshalltown: New fire station, $6,000.
Nevada: Some new hose.
Webster City: Just completed.

MASSACHUSETTS.

Westfield: New motor driven apparatus.

MICHIGAN.

Highland Park: Under consideration.
Holland: Under consideration.

MINNESOTA.

Albert Lea: Auto truck.
Mankato: Engine.

MISSOURI.

Columbia: A new auto fire wagon has been ordered.
Hannibal: $1,000.

MONTANA.

Great Falls: Fire and police departments; $50,000 new building.
Helena: New auto truck.

NEBRASKA.

Norfolk: 1,000 ft. of hose.
University Place: City hall, fire hose and chemical extinguisher.

NEW HAMPSHIRE.

Littleton: 1,000 ft. of hose.

NEW JERSEY.

Beach Haven: $5,000 fire house, new equipment and alarm system.
Ocean City: 1 steam fire engine and 1 aerial truck; 1 auto chemical.
Rutherford: Auto apparatus being agitated.
West New York: 1 new auto truck, aerial; 3 new fire houses.

NEW YORK.

Binghamton: 1 new motor apparatus (under contract).
Ilion: $5,000 auto chemical and hose truck; to be submitted to the taxpayers March 4.
Troy: Fire alarm telegraph and police patrol system; Gamewell system.

NORTH DAKOTA.

Minot: Motor truck.

OHIO.

Steubenville: Motor truck; new hose.
Wellsville: Motor fire truck a possibility.

PENNSYLVANIA.

Monongahela: 1,000 ft. of hose.
Swissvale: 500 ft. hose.

TEXAS.

Paris: Chief's car and 1 hook and ladder.

VERMONT.

Bellows Falls: 1,000 ft. hose.

VIRGINIA.

Newport News: Construction tractor hose wagon and chemical extinguisher.

WASHINGTON.

Aberdeen: One auto engine, 1 auto hook and ladder, 1 auto hose cart.

WISCONSIN.

Eau Claire: New Chief's auto.
Madison: One new truck.
Oshkosh: An appropriation of $3,500 to purchase auto hose wagon.

CANADA.

Hamilton, Ont.: $25,000.
Prince Rupert, B. C.: Fire department additions, $10,000.

Police Departments

CONNECTICUT.

Ansonia: New alarm system.

ILLINOIS.

Joliet: Chief asks for appropriation for motor ambulance and patrol wagon.
Quincy: New electric signal system.
Rockford: Motor patrol.

INDIANA.

Fort Wayne: 2 miles of cable.

IOWA.

Dubuque: New patrol auto $3,000.

KANSAS.

Chanute: Proposed second story addition to jail, about $1,000.

MASSACHUSETTS.

Westfield: Signal system and new patrol wagon.

MICHIGAN.

Holland: Under consideration.

MONTANA.

Great Falls: Police and fire department, $5,000 new building.

NEW YORK.

Troy: Police patrol system; Gamewell system.

OHIO.

Zanesville: One motorcycle; one auto patrol.

WASHINGTON.

Aberdeen: One auto patrol.

WISCONSIN.

Madison: 1 new patrol.

QUESTION DEPARTMENT

Purification of Sewage in Long Sewers

I wish you would state in your question department if you know of any work or article on the purification of sewage by flowing thru long pipes or sewers. tI is known that sewage is broken up and purification does take place in flowing in long channels, but I have not been able to get any definite data on this subject P., C., ———, Ill.

Some books on sewerage and sewage disposal mention the fact that some decomposition of sewage takes place during the flow thru a long sewer, but the amount is so slight and the possibility of getting rid of the products of decomposition and thus actually purifying the sewage is so remote that no account is taken of what takes place. Indeed, for some of the methods of purification in use the decomposition which takes place in the sewer is troublesome, because it admits an element of uncertainty and the action in the purifications tanks cannot be so definitely predicted. In general, it may be said that the flow of undiluted sewage in any channel of probable or reasonable length gives it little opportunity for purification of the sewage, and if the channel is covered, as in a pipe or sewer, the condition is less favorable because of lack of sunlight and free air, and the confinement of the gases of decomposition produces an additional source of nuisance and difficulty.

There may be some apparent improvement in the liquid on account of disintegration of solids, which would not be equally evident in chemical and biological analyses.

Can our reads cite any instances of the sort named by our correspondent?

Disposal of Snow From Street Railway Tracks

I would like to receive such information as you may be able to furnish relative to ordinances intended to impose upon street car companies the cost of removing snow accumulations caused by their snow plows on either side of the car tracks.

E., City Solicitor, ———, Pa.

The question of the distribution of the expense of removing snow from streets between the city and the street railway company was discussed at some length in MUNICIPAL ENGINEERING, vol. xl, p. 34, and this article may contain the information desired. It refers to the methods in use in several cities. Quotations from street railway franchises and ordinances in Elgin and Moline, Ill.; Dayton, O.; Rome, N. Y., are given, and also full descriptions of methods of taking care of the snow.

Building Ordinance for Small City

A quite recent disastrous fire in the business portion of this town (3,000 pop.), largely helped along by inferior materials and construction of some of the business houses, has called the attention of the board of aldermen of the city to the necessity for stricter regulations of the materials and construction of such houses. Our statute (charter) gives the city ample powers in the premises, and I am seeking, at the request of the city council, suggestions and forms of ordinances applicable in such cases.

The city and myself will greatly appreciate it if you will publish in MUNICIPAL ENGINEERING, if not too long, or tell me where I may find an approved form of ordinance relating to this matter.

R. N. BANISTER, City Attorney,
Eldorado Springs, Mo.

A building ordinance will cover the case. The Indianapolis ordinance, which can be obtained of the building inspector, in the City Hall, is a booklet of perhaps 150 pages. Cleveland has a very excellent building ordinance, which can be obtained from the city attorney or the building inspector. MUNICIPAL ENGINEERING has published two articles on the subject of the removal of old buildings within fire limits and ordinances governing the same in vol. xxxvii, p. 184, giving the sections of the ordinances in Cincinnati and Dubuque governing this matter, and in vol. xxxviii, p. 271, which gives

the provisions in Atlanta. These ordinances are, doubtless, more extensive than would be necessary in a small city. The discussions in the articles referred to will be of interest, especially since the right of a city to remove old buildings within fire limits established after these buildings were constructed has not yet been definitely settled by the courts.

Ordinance Requiring Ornamental Trolley Poles

The common council of this city is desirous of passing an ordinance providing for the installation of ornamental iron trolley poles in certain districts of the city. May I impose upon your service for reference to ordinances covering the subject matter of my inquiry?

I wish to express my satisfaction with the results which I have been deriving from the examination of your magazine since I have been a subscriber.

R. K. P., City Attorney, ———, Ore.

Can our readers supply our correspondent with copies of such ordinances as he desires? Most street railway contracts are in such form that a special agreement must be made to cover such changes as that desired and a special ordinance or contract must be drawn to cover the particular case. No ordinance compelling the street railway company to use the ornamental poles is on file. In some cases the matter could be taken care of under the common provision in street railway franchises that the character of poles used must be satisfactory to the city authorities, which is supplemented in some cases by a provision that the city can order changes. Unless clearly stated in the franchise, however, it is hardly probable that the city could by ordinance force the company to expend money simply for ornamentation for poles or to substitute ornamental poles for poles otherwise satisfactory and not objectionably ugly, which have already been approved. A mutual agreement would seem to be necessary.

A change from wood to iron could be required on other grounds, and may give an opportunity to obtain part, at least, of what is desired.

Specifications for Asphaltic Concrete

I notice in your November issue an article entitled "Preparing Asphaltic Concrete," by H. S. Rogers of Chicago. Where could I get the specifications under which this work is done.

W. I. THOMPSON,
Henderson, Ky.

The specifications used in laying the asphaltic concrete described in the article referred to are those used by the South Park Board of Chicago, of which Mr. Linn White is the chief engineer.

Electric Light Franchise

I have before me the duty of drawing a franchise for furnishing electricity for heat, light and power, and would be glad to have any information or suggestions from your information department relative to proper provisions for the protection of the interests of the city and the public in the premises.

R., City Attorney, ———, Okla.

A form of franchise will be found in MUNICIPAL ENGINEERING, vol. xliii, p. 322.

Ordinance Regulating Peddling

In your suggested ordinance, on page 178 of your September number, regulating peddling, I notice you include in Section 1, "Any person going about said city on foot or otherwise, taking orders for or selling any kind of goods, wares or merchandise by sample, to be afterwards delivered." Assuming that this suggestion is supported by court decisions distinguishing in some way such provision from the interstate commerce clause of the constitution, I write to ask if you can refer to the court decisions so holding. Your suggested ordinance providing that this provision shall not apply to drummers selling goods by sample to resident merchants, recognizes that this last proviso does come within the interstate commerce clause and that cities could not pass an ordinance taxing such business.

It has become a custom in many cities for houses to have agents going from house to house, taking orders by samples of various lines of merchandise. It ought to be regulated, but whether it can or not is the question I would like to know more about by reference to the decisions so distinguishing.

P., Mayor, ———, Kans.

The question raised is one which does not seem to have been settled. There are decisions that a drummer is not a peddler, as in Kansas City vs. Collins, 34th Kansas 434, but that a man selling by sample may be a peddler if he is so defined in the statutes or ordinances governing the matter, such as Newcastle vs. Cutler, 15th Pennsylvania Superior Court 612, and Spanish Fork vs. Mortenson, 7 Utah 33. A clear distinction between mercantile agent, drummer and peddler is made in Brookfield vs. Kitchen, 163 Missouri 546. A drummer sells to merchants, and the mercantile agent sells to the consumers, and the difference in their treatment seems to be based on this difference in fact.

Can our readers give references to decisions on the subject or to ordinances which are practically in control of the matter?

Prices for City Lot Surveys

Can you refer me to article in MUNICIPAL ENGINEERING concerning city lot surveys, etc., prices charged and ordinances governing such work where it is done by the city engineering department?

W., Port Huron, Mich.

In MUNICIPAL ENGINEERING, vol. xlii, p. 470, will be found a descriptive list of

articles on "Cost of City Engineering and Fees for Municipal Engineering Services." The only article there listed which seems to touch the point in the question closely is one on "Lot Surveys by the City Engineer," in vol. xxxiv, p. 365, which gives a schedule of fees and some suggestions as to provisions of an ordinance, which are subject to modification according to local customs and state laws.

Record of Meter Readings

We are endeavoring to secure a book for keeping records of meter readings and numbers and have been referred to you. If you have anything to offer in this line we would appreciate your kindness in sending us a sample page, or giving us full description of same.

P., Pittsburg, Pa.

The American Water Works Bookkeeping System does not include a meter reading book. The most convenient is one with removable leaves, of pocket size. It is printed in columns, one for the date, month and day; one for the meter readings, one for the difference of meter readings, or amount consumed and one for the amount reduced to the unit in which water is billed.

At the top of each page is the house number and other description of property or person served by the meter, the name of the person, the numberr of his account on the books, or other method of identifying or indexing it, the number of the meter and its description.

Some superintendents prefer to have in the meter reading book only the first three columns named and but one identification of the account, keeping all the other information on cards or in record books such as the cards and metered water register of the American Water Works Bookkeeping System, copying the readings from the meter into the account books each month or each quarter as they are made.

The sheets being removable, when an account is closed or a sheet is filled it can be removed and filed where it belongs or destroyed and a new sheet inserted for new account at the same place, or continuance of the old account. The sheets in the meter reader's book are arranged in the order most convenient for him in reading the meters, and the method of identification of accounts used should be that which will make it easiest to find the accounts when the readings are transferred to them.

An elaborate form of meter reading record used in Jamestown, N. Y., will be found in MUNICIPAL ENGINEERING, vol. xlii, p. 121. Some modifications are suggested in connection with it and others will readily suggest themselves.

Will our readers send samples of the sheets they use in their meter reading books, filled out to show the method of using them?

Ordinance Fixing Quality and Rates for Gas

Can you furnish us with a form of ordinance fixing the rate and quality of gas for the consumers of a city of 6,000, with a daily gas consumption of one hundred thousand feet? What rate per thousand feet is a reasonable rate under the above circumstances?

C., City Attorney, ———, Mich.

A full form for a gas franchise ordinance is given in MUNICIPAL ENGINEERING, vol. xlii, p. 185. It covers all the points usually included in a gas franchise, but the quality. Small plants generally use the oil or water-gas methods of making gas and can supply 18-candle-power gas without difficulty. Since the advent of incandescent mantles there has been a tendency to fix the standard of quality at 600 or 650 heat units per cubic foot of gas at atmospheric pressure. The former is about all that a water-gas plant can reach economically.

The rates fixed under the ordinance referred to by an expert commission were $2 per 1,000 cubic feet for the first 500 cubic feet or less, reducing by stages for larger consumption to $1.25 per 1,000 for all over 10,000 cubic feet.

How to Build Residential Sewage Disposal Plant

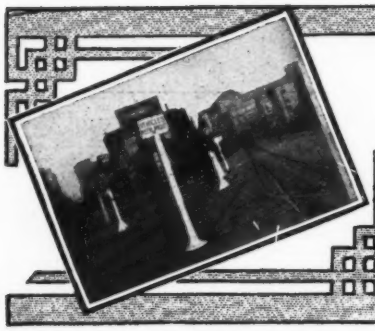
In MUNICIPAL ENGINEERING, vol. xxxvi, April, 1909, page 242, you cite "How to Build Residential Sewage Disposal Plant," vol. xxxv, 244. Would this furnish sufficient instructions for the construction of such an affair, for the use in a one-story 5-room dwelling, accommodating not more than four persons regularly? I desire to dispose of kitchen sink and bath room products, both if may be, but in any case of that from the water closet. Would this plan be expensive or about how expensive in my case?

M., Palestine, Ill.

The number referred to gives good general specifications for the construction of two designs of settling basins for disposal of sewage from a single house.

In vol. xlii, p. 229, is a set of plans for a residential sewage disposal plant, including septic tank and dosing chamber, intermittent sand filter underground, and a sub-surface absorption system with underdrains, from which one can select what is most nearly applicable to his case. The exact dimensions are not given in order that they may be determined to suit the particular case.

Other articles of interest, not mentioned in the articles referred to in the question, are "The Russell Sewage Disposal System," vol. xlii, p. 347, and "Disposal of Single House Sewage," vol. xli, p. 42.



WORKERS IN THE FIELD

William C. Perkins

Assumes Important Position.

One of the most important advances in the brick paving industry has developed during the past month. When the Dunn Wire-Cut-Lug Brick Co. placed its new form of brick on the market it realized keenly that, regardless of how good its product might be, unless engineers were familiar with its character and contractors thoroly versed in its use, but a small portion of its value would be utilized. Early in its history this organization appreciated that the most effective help could only be given thru the services of an efficiently organized department of engineers of unquestioned ability and standing in their profession. After several years an inspection and service department is now being organized with an engineer in charge whose services will be of great value to engineers and contractors over the entire country.

The person in charge will be W. C. Perkins, C. E., Mem. Am. Soc. C. E., acting as supervising engineer.

Mr. Perkins has been identified with the good roads movement, as one of its leading highway engineers for many years. For seven years he was in the employ of the city of Philadelphia as superintendent of construction of the Fairmount Park boulevards, walks and bridle paths. While engaged in that work he laid and supervised the construction of a large number of the wonderful highways for which this park system is famous.

Later he was connected with the New York State highway department, and held the position of resident engineer in charge of the Niagara and Orleans counties highways, with headquarters in Niagara Falls. From this position he has just received a leave of absence from state work. By securing this privilege Mr. Perkins retains his standing in the state civil service, in which he has a very high rating as an engineer.

While acting in the above capacity he has laid many miles of roads with wire-cut-lug brick, and has made a very careful study of brick highways in general.

Appreciation of his work and the high regard in which it is held by the people of the counties he has served has been expressed by the Niagara Falls Gazette as follows:

"The service given the state by Mr. Perkins as resident engineer here for the last two years, during which he had charge of the work of building the Niagara county and the Buffalo-Niagara Falls boulevard, and its extension to Youngstown, as well as the Ridge road trunk state highway, has been of such splendid nature that his leaving is a cause of greatest regret among the friends of good roads in this end of the state. He has been with the state highway department since 1906, during which all of his activities have been in this section.

"All of the Niagara county good roads have been constructed under his charge. That he, as a Republican, was appointed resident engineer under a Democratic state administration and has continued in such appointment until his voluntary leaving is an evidence of the superior service he has given in such capacity."

Creosoted Wood Block in Detroit

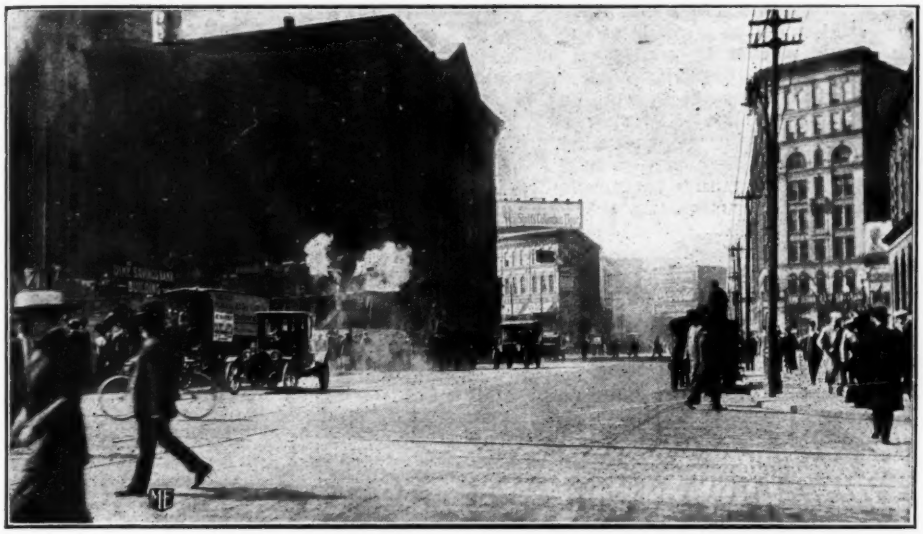
The Editor of MUNICIPAL ENGINEERING:

Sir—In the year 1905, the city laid its first street of creosoted long leaf yellow pine. This was on Catherine street, from Chene to Jos. Campau, 2,062.23 square yards. The following year Belle Isle bridge was paved with the same material, taking some 6,700 yards. This bridge is the only traffic connection between the city and Belle Isle park. The traffic, especially in the summer time, is enormous. Up to the present date no money has been expended upon the maintenance of this roadway.

In 1907 six streets were paved, taking in all, approximately 25,000 yards.

In 1908 ten more streets were paved, with a total of 29,500 yards.

In 1909 seven streets, with a total of 21,356 square yards.



CREOSOTED WOOD *Block Pavement on Griswold Street, Detroit, Mich.*

In 1910 eight streets, totaling 28,408 square yards.

In 1911 eleven streets, with a total of 48,229 square yards.

In 1912 twenty-nine streets, with an approximate total of 158,500 square yards.

The total amount laid and in the process of construction at this time is 319,820 square yards.

The only appropriation asked for maintenance on this work was $500.00 allowed in 1912.

In 1907 the specifications called for 3-inch long leaf yellow pine block, with a treatment of sixteen pounds of creosote oil to the cubic foot. In 1908 this was changed to a 4-inch, 16-pound block, and in 1909 it was again changed to a 3½-inch, 20-pound treatment, which specifications have been in vogue with perfect satisfaction since that time.

The accompanying table gives a list of streets already paved, and to be paved, with creosoted wood block, totalling nineteen miles.

CREOSOTED WOOD BLOCK STREETS IN DETROIT.

Street	Length ft.	Sq. Yards
Avery	4,190.60	14,905.81
Burroughs	925.90	2,782.69
Bagg	357.60	950.29
Brady	1,618.30	4,960.88
Brooklyn	5,067.10	15,934.57
Burns	986.00	3,171.57
Belle Isle Bridge	2,636.00	6.761.00
Clinton (Kreodone)	1,077.50	2,924.48
Catherine (Kreodone)	871.60	2,062.23
Cass	546.00	1,872.93
Cherry	954.20	2,978.77
Champlain	2,077.20	5,482.73
Edison	1,756.38	4,924.60
Euclid	1,269.02	3,763.98
Eliot	2,153.10	6,382.80
Fort E.	1,172.90	3,022.32
Forest East	1,348.30	3,849.95
Fourth	3,181.10	9.499.11
Fourteenth Bridge	245.00	720.00
Forman	610.51	1,848.56
Grand River	3,696.90	18,569.13
Griswold	2,500.80	10,937.38
High East	1,586.50	5,409.89
High West	1,820.90	5,844.61
Hudson	3,862.60	12,469.80
Hancock West	2,652.20	8,383.60
John R.	1,908.90	6,195.08
Jay	700.30	2,073.86
Kercheval	3,647.01	10,141.68
Larned West	120.00	527.07
Larned East	5,884.05	21,593.96
La Fayette	5,765.51	23,669.00
Locust	130.90	304.18
Longfellow	803.79	2,232.75
Michigan	5,156.00	27,924.26
Maybury	2,350.10	7,627.15
Martin Place	591.93	2,130.37
McClellan	3,008.20	10,869.85
National	4,145.10	12,602.15
Orleans	527.00	1,803.76
Park	3,255.80	11,100.00
Randolph	532.20	2,361.14
Rowena	1,236.30	3,610.07
St. Antoine	284.70	1,026.87
St. Aubin	3,868.00	12,609.29
State	85.00	245.23
Sixth	245.60	658.21
Seyburn	853.50	2,751.86
Seminole	823.27	2,383.11
Third	1,705.60	5,886.80
Twelfth	2,179.30	6,897.21
Van Dyke	2,506.60	8,314.69
Warren West	1,240.80	2,982.43
Total	102,719.86	350,835.71

The contractors for the years 1908, 1909, 1910 and 1911 required the manufacturer to leave a guarantee deposit fund equal to 5 per cent. of his contract available to the city for a period of five years, for replacements caused by defective material. This practice was discontinued this year, as it was apparent that the

streets were so satisfactory that no charge could be made against this fund.

Close inspection is made at the plant of the manufacturer by competent and reputable chemical testing companies and the lumber is also inspected before being cut into blocks. Reports on each car are filed with the city and material not in accordance with the specifications is rejected at the manufacturing plant.

The large demand for this material, during the present year, came principally from the property owners, not only in the downtown section, but also in the residential districts.

There are now, as shown, between sixty and seventy streets and every one of them is in perfect condition.

The days of high class municipal buildings and poor pavements in the same town are rapidly passing. The reason is simple. It is just as paradoxical as high class garments and inferior shoes on the same man. One of the best traveling advertisements of a city is the transient visitor and he usually takes a ride before he leaves town. The municipal buildings may be ever so ornate, but if he has to hold tight to his seat to keep from somersaulting out of his machine, his impression of that town will not be printable. And the feelings and sentiments of residents are not much different than those of the transient. The automobile is bringing with it a greater demand for smooth pavements. Municipal officials and taxpayers now realize, however, that buying paving is simply paying in advance for a certain and justly expected amount of wear-service and that some pavements really cost more than you pay for them.

While the first cost should be considered, it should be looked upon only as a part of the entire cost, as economy is purely a matter of value, not of prices.

A really good pavement for any purpose will outwear, two to one, the pavement many taxpayers often think they are "saving money on." In buying paving, it's not what you pay, but what you get for what you do pay for. For heavy traffic, creosoted wood makes a most excellent pavement and its up-keep cost is exceedingly low.

JACOB J. HAARER, Commissioner,
Dept. of Public Works, Detroit, Mich.

Cheapening Road Construction in Michigan

The Editor of MUNICIPAL ENGINEERING:

Sir—In 1912, the Genessee County Road Commission laid twelve miles of stone road and eighteen miles of gravel road, thirty miles in all.

During 1913, we anticipate making fully ninety miles of modern roadway, mostly gravel.

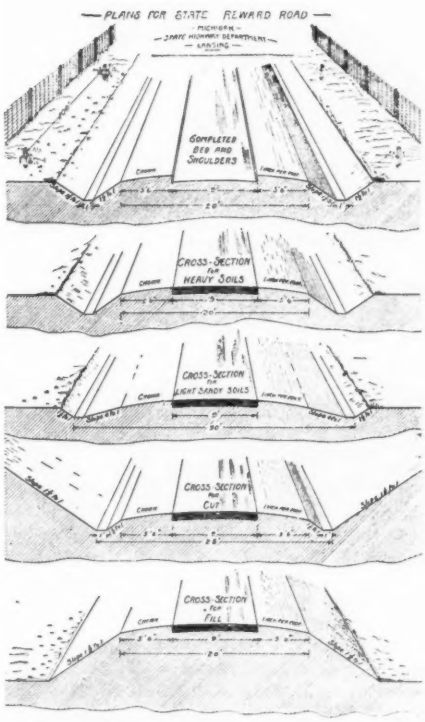
Our roads are twenty feet in width exclusive of side ditches or gutters and have a cross-section oval in form, with an average of one inch to the foot from the inner edge of ditches or gutters to the center line of the road. Twenty feet is too narrow for the roadways of heavily traveled roads, and the State Highway Department recommends that turnpikes be made from twenty-two to twenty-four feet wide where the travel is heavy. In general, earth for fills is taken from cuts. In no cases are deep, unsightly ditches cut along the roadside for the purpose of making fills.

CREOSOTED WOOD *Block Pavement, Woodward Avenue, Highland Park, Detroit, Mich..*

NICHOLS ROAD, *Montrose Township, Genesee County, Michigan.*

In clay soils, trenches are cut thru the shoulders, making outlets into the side ditches for water that may collect in the metal bed during construction and later before the surface becomes hard and waterproof. These trenches are eight inches or more in width and slightly deeper than the metal bed. They are placed at low points in the grade and not farther than 100 feet apart in retentive soils.

After the road has been graded the metal bed is formed in the central part of the road grade as follows: Shoulders of firm earth or other suitable material are placed on each side of the metal bed not less than nine feet apart or such greater distance as may be required to retain the width of metal specified. The shoulders extend to the side ditches or gutters at the same grade and curvature as required for the finished road.



PLANS *for State Reward Roads.*

After the shoulders and metal bed have been formed, the whole roadway is rolled until no more compacting is possible. The hollows developed by this rolling are filled and the roadway is again rolled and left in solid and firm condition, everywhere parallel to the finished roadway, the metal bed being seven inches below the finished grade and having the same crown. In deep, mealy sand, where rolling is impracticable when subgrade is shaped, marsh hay, rotten straw or fine brush is laid on subgrade to prevent the first course of gravel from mixing with the sand.

After the road has been graded and rolled, a layer of crushed stone or slag is spread on the prepared bed to a uniform thickness.

Improved road rollers and spreading cars have done much to modernize road building as well as to bring the cost of construction down to such a low figure as to make possible jumps from twenty miles of actual accomplishment in one year, to ninety miles the succeeding year.

Where there is enough work to keep a hauling machine busy, and suitable provision can be made for loading and unloading quickly, a hauling engine may be used to advantage, and is about 50 per cent. cheaper than horses, but in purchasing, road commissioners cannot pay too strict attention to gearing and traction wheels. There is no class of road building machinery which has been so highly developed as the steam road roller. In looking over a road roller with the view of purchasing, particular attention should be given to an investigation of the gearing and wheels. A set of rear wheels should last, under ordinary service, at least ten

years. Wheels have been in service fourteen years. The gearing on steam rollers should be of steel, cut and fitted as nicely as in any high-class automobile.

We own and operate, with great success, several road rollers, scarifiers, dump cars and water wagons, made by the Port Huron Engine and Thresher Co., Port Huron, Mich. These road rollers are durable on account of their simplicity of construction and can be entrusted to unskilled labor. These rollers are suitable for general hauling purposes because of maximum power, large boiler and engine capacities.

The ordinary traction engine is not suitable for hauling on public roads or streets, because the lugs or corrugations of the driving wheels damage good roads by cutting and loosening the surface. The corrugations or little hollows left in the road by the lugs of the regular traction driver interfere with the easy shedding of water. On the other hand, the roller improves the road, smoothens the surface for easy drainage of water and for easy traveling. Also, if the holes or low places are filled with suitable material previous to the passage of the roller and the "cars," instead of damaging the road as by the ordinary traction engine, our outfit will improve and repair the road.

The rear rolls of Port Huron general purpose rollers are beveled or pitched to provide for traveling on a good road without flattening it; or to provide for assisting in crowning while rolling. Such pitching aids in causing a suitable binding pressure on the loose material, and in giving the street or road a contour for shedding water.

The Port Huron scarifier, when used in conjunction with the steam roller, reduces picking costs to a minimum, as it will prepare for rolling from four to five thousand square yards of road surface per day. Scarifying does not affect the foundation as it loosens the surface. This method is greatly to be commended.

LYNUS WOLCOTT, Road Commissioner,
Genesee County, Mich.

Bitulithic Pavement on Slag Foundation

The city of Birmingham, Ala., has practically mountains of slag about its iron furnaces which are being used in street construction with excellent results. The accompanying photograph shows the condition of a bitulithic street laid on a slag foundation, which was taken up to lay a street car track. Such a pavement is certainly a satisfaction both to the city owning and using it and to the company which designed the mixture and put it in place.

BITULITHIC *Pavement on Slag Foundation in Birming ham, Ala., torn up to lay street railway track. An unusually fine example of street paving.*

Truck for Handling Water Meters

The Editor of MUNICIPAL ENGINEERING:

Sir—A 1½-ton Federal truck, as illustrated, has recently been placed in the service of the meter division of the St. Louis water department. The overhead design is of special interest, in that the quick loading and unloading of half-ton meters can be handled by the driver alone.

The weight of the chassis is 4,000 pounds and it cost $1,875. The body weighs 1,500 pounds, is 5x11 feet inside, and cost, complete with trolley and chain block, $290.

The 4-inch I-beam running the entire

length of the body and extending 30 inches over the rear, is supported by a light steel framework of 2½-inch T-bar. A half-ton trolley and chain block is mounted on this I-beam.

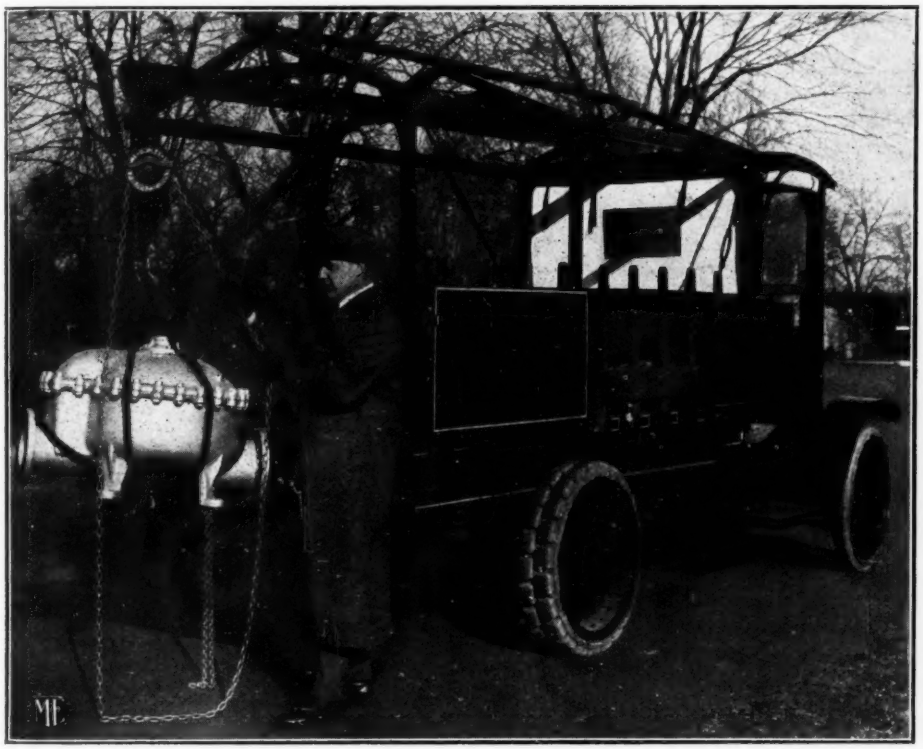
In replacing and installing large meters the truck backs against the curb and lifts the meter from the box in the sidewalk directly into the truck, or vice versa, by means of the trolley-chain block arrangement. Before taking out a large meter the flanged joints are loosened by

Maintenance: truck per month .....$ 85.00

Saving per month..... $180.00

The indications are that these figures will improve as the men become better accustomed to the new system and the weather becomes milder.

F. L. Bock,
Meter and Tap Division,
St. Louis Water Department.



WATER DEPARTMENT *truck for handling meters and heavy castings.*

Wages: 6 men and driver 435.00 $520.00

means of a meter puller especially designed for quick service in connection with the truck.

The truck covers a route of 15 to 30 miles a day in transferring the men from one job to another. To date the data show that a crew of 6 men divided into pairs do the work of 5 single-horse wagons with 10 men.

In figures the savings would be as follows:

Maintenance: 6 horses and wagons per month.$100.00
Wages: 10 men..... 500.00 $700.00

Cost of Machine Concrete Mixing Compared with Hand Mixing

The Editor of Municipal Engineering:

Sir—The municipal contractor who starts in on a big job via the hand mixing method and later adopts improved machinery for mixing readily appreciates the savings effected.

We spent the summer of 1911 and 1912 on a concrete pavement job in this city, using the hand mixing method in 1911 and improved machine mixing in 1912—enabling us to make the following comparisons:

	Hand Mixing cu. yds.	Machine Mixing cu. yds.
Average yardage per man on street pavement (except watchman, water and sack boys)	2.31	3.83
Average yardage per man on street pavement (including all engaged in the mixing operation)	3.04	4.788
Cost per cu. yd. of street pavement (including only wheelers, loaders, mixers and spreaders)	$0.64	$0.508
Cost per cu. yd. of street pavement (including all engaged in the mixing operation)	1.075	0.74

The machine responsible for the above savings, and which we are now operating, is a No. 14 Koehring special paving mixer, which has an average yardage of 200 per day with the following gang:

In Front of Machine:

3 stone wheelers,
8 stone loaders (two loaders per barrow),
3 sand wheelers and loaders (two barrows),
1 cement wheeler (three sacks per load),
3 machine men (fireman, engineer, bucket man).

At Rear of Machine:

2 spreaders,
1 tamper,
1 template setter and block placer,
2 finishers.

This street paving machine renders unnecessary the barrow hauling of concrete, as it charges, mixes and deposits automatically. The bucket travels on a 25-foot boom, which swings through an angle of 170 degrees. The hinge type skip has a capacity of 14 to 17 cubic feet. feet. Our experience is that fuel burned runs from 3½ to 2 pounds of bituminous coal per square yard of pavement laid. This machine will easily ascend a 12 per cent. grade, and we run it along the work on plank sections, 8 feet in length. As a rule we place our material directly on the ground, placing the sand and granite chips on one side and the stone piles on the opposite side of the road ahead of the machine. We place the sacks of cement on top of the stone piles and the granite chips in between the road piles.

Our skip charge for the wearing surface consists of:

4 sacks cement,
3 barrows sand,
2 barrows granite chips.

The following calculations show the detailed labor costs of job A as well as summaries of the unit costs of jobs A, B, C and D, of the work above referred to:

JOB A, 3,100 Sq. Yds.

Base 5 in. 1:3:5.
Average out put equals 530 sq. yds.
Time—5.7 hrs.

	Total	Per sq. yd.
9 men on rock.....at 22½c	$11.55	$0.0218
3 men on sand.....at 22½c	3.85	0.0073
1 man at skip.....at 22½c	1.28	0.0024
1 man wheeling cement .....at 22½c	1.28	0.0024
1 man leveling concrete .....at 25c	1.43	0.0027
1 helper leveling concrete .....at 22½c	1,28	0.0024
1 tamper .....at 22½c	1.28	0.0024
1 engineer .. ..at 25c	1.43	0.0027
1 fireman .....at 25c	1.43	0.0027
1 bucket operator...at 15c	0.86	0.0016
1 water boy.....at 05c	.28	0.0005
1 foreman .....at 45c	2.57	0.0048
Total	$28.80	$0.0543

Wearing surface, 1½ in. 1:1:1.
Average output, 530 sq. yds.
Time, 2.8 hrs.

	Total	Per sq. yd.
4 men on granite chips .....at 22½s	$ 2.52	$0.0048
4 men on sand.....at 22½c	2.52	0.0048
2 men at skip.....at 22½c	1.26	0.0024
2 men wheeling cement .....at 22½c	1.26	0.0024
2 rough spreaders..at 22½c	1.26	0.0024
1 fine spreader (also tamps top) .....at 25c	0.70	0.0013
1 fireman .....at 25c	0.70	0.0013
1 engineer .....at 25c	0.70	0.0013
1 bucket operator..at 15c	0.42	0.0008
1 water boy.....at 05c	0.14	0.0002
1 sack boy.....at 05c	0.14	0.0002
1 foreman .....at 45c	1.26	0.0024
Total	$12.88	$0.0245
Finishing (530 sq. yds.)		
1 finisher 13 hrs....at 25c	$3.25	$0.0061
1 helper, 13 hrs.....at 22½c	2.93	0.0055
Total	$6.18	$0.0116
Form Setter.		
1 man, 10 hrs.....at 22½c	$2.25	$0.0042
Miscellaneous.		
1 man trimming grade, 10 hrs.	$2.25	$0.0043
2 men cleaning up stone, sand, etc., while top is being placed. 4.3 hrs each.....	1.49	0.0036
Total	$4.19	$0.0079

The time required for moving the machine was 15 hours for 8 moves. The wearing surface organization is charged with moving the machine; so to arrive at cost take 1.5/2.8x$12.88, which equals $6.90.

Unit cost equals 0.013 per square yard.

SUMMARY, JOB A.

	Per sq. yd.	Per cu. yd.
Development expenses	$0.0090	$0.0500
Watchman	0.0050	0.0277
Base	0.0543	0.3008
Top	0.0245	0.1357
Finishing	0.0116	0.0643
Setting Forms	0.0042	0.0233
Miscellaneous	0.0079	0.0438
Cleaning street, boulevard, etc.	0.0055	0.0305
Moving machine	0.0130	0.0730
Total	$0.1350	$0.7481

The average output of 530 square yards or 95.7 cu. yds., with this organization is conservative. With no delays of any sort it could put in nine sections of 180 lin. ft. This is equivalent to 600 sq. yds. The greatest problem is to get sufficient raw material on the street. With 11 men on stone, an average of 600 sq. yds. can be placed, while a maximum of 670 sq. yds. has been attained. The cost of paving alley returns on a 30-ft. street was approximately 25 per cent. greater than the cost of paving the center of the street. This was due to the necessity of shoveling concrete for a distance of 15 feet since the boom reached only to the curb.

SUMMARY JOB B (2,300 Sq. Yds.)

	Per sq. yd.
Development expenses	$0.0088
Watchman	0.0048
Base	0.0526
Top	0.0237
Finishing	0.0112
Form setting	0.0041
Miscellaneous	0.0071
Cleaning street, boulevard, etc.	0.0054
Moving machine	0.0125
Total	$0.1302

Laborers' wages were 22½ cents per hour, and conditions were almost identical with those of Job A.

SUMMARY, JOB C (3,500 Sq. Yds.)

	Per sq. yd.
Development expenses	$0.0185
Watchman	0.0060
Base	0.0595
Top	0.0268
Finishing	0.0122
Form Setting	0.0047
Miscellaneous	0.0080
Cleaning street, etc.	0.0061
Moving machine	0.0141
Total	$0.1514

Laborers were paid 25 cents per hour on this job. Delays were frequent, due to shortage of rock, sand and men.

SUMMARY, JOB D (1,600 Sq. Yds.)

	Per sq. yd.
Development expenses	$0.0155
Watchman	0.0060
Base	0.0584
Top	0.0260
Finishing	0.0120
Form setting	0.0042
Miscellaneous	0.0080
Cleaning street	0.0041
Moving machine	0.0130
Total	$0.1472

C. H. HUBBELL, Manager,
Hubbell Construction Co., Davenport, Ia.

Garbage Disposal in Canton, Ohio

The Editor of MUNICIPAL ENGINEERING:

Sir—For the past twelve years we have disposed of all garbage by means of incineration and our opinion is that this method is the most sanitary and most economical. Our destructor plant is owned by the city and was erected by The Dixon Engineering & Construction Co., of Toledo, Ohio, in 1901. The entire plant, including furnaces, building, chimney, etc., cost $20,000.00.

The building is of brick, steel and concrete construction, two stories high. The firing floor is of concrete, and the dumping, or upper floor, is made of ¼-inch steel plate. Access to the dumping floor is had by means of a timber incline approach. The driving platform on front side of building is also of timber construction.

Chimney is of common brick, 80 feet high, and lined thruout with fire brick.

The incinerator proper consists of two furnaces, built in an elongated fashion, with connecting flue in the middle. As it is arranged in two units, it is never shut down, as, if one unit is in need of repairs, these repairs can take place while the other is being operated, there being dampers to completely shut off either unit. We have found this to be a feature of economy, inasmuch as when our collections run light, we find it more economical to operate one unit at full capacity, and continuously, than two units at less than full capacity, and intermittently.

The refuse vehicles drive on to the charging and driving platform, access to which is had by means of the inclined approach described above, back up to the large doors and dump their contents into the charging holes, situated in top of furnace, and the refuse drops directly into the furnace. It is held in suspension in the middle of the furnace, resting on fire brick grates. In the front end of the furnace, at nearly a level with the garbage grates, is a grate on which fuel is used when there is not enough combustible refuse delivered at the plant to maintain the fire. The flames from this grate pass over the mass of refuse held on the fire-brick grates, and consume same from the top. Situated also in the front end of the furnace, beneath the fire-brick grates, adjacent to the other fuel grate, is another fuel grate. The flames from this grate pass under the garbage held in suspension on the fire-brick grates, eating thru the fire-brick grates, as it were, as the fire-brick grates are situated about 6 inches apart, and burn the refuse from below. The gases pass out into another chamber, termed the stench chamber. Situated in this chamber is another grate, termed the stench grate. On this grate is maintained a fire of coke. Above this gate is a checker-work of fire clay tile. The fire from the stench grate heats these tile to a very high temperature, and the gases coming from the garbage chamber must pass over the stench fire and strike

the surfaces of the heated tile, raising the temperature of the gases to a degree well above 1250 degrees Fahrenheit, completely destroying the odors.

The furnace in the main consists of a steel jacket of ¼-inch steel plate, reinforced and braced by angles and tees of structural steel. The minimum thickness of the fire-brick lining is 9 inches, and the very best grade of fire brick was used for this purpose. The repairs on the lining have been very small. However, we have given the furnaces that careful attention which is necessary on any plant of this kind.

No mechanical draft is used in this plant, but we understand that the Dixon company are building forced draft de-

cineration of the above refuse in furnaces either with a strong natural draft, or by means of a forced draft, is undoubtedly the most sanitary method known, since it completely disposes of the organic matter without repeated handling. Our system of hauling the cans to the furnace and not exposing the contents while collecting, we believe, is very effective as a means of decreasing the menace of flies, since the fly is deprived of his source of livelihood. The fly, being the carrier of germs, cannot, therefore, carry germs from the garbage to some table or to some individual.

Taken all in all, the investment made in a garbage disposal plant is a good one, when one considers what it costs a mu-

GARBAGE INCINERATION *Plant at Canton, O. Note sanitary cans unloading at left, clean cans on stand in rear of plant.*

structors at the present time. We get our draft from the high chimney, and this draft, with the use of a small amount of additional fuel, is sufficient to consume all the refuse to a fine ash, and without odor.

The garbage consists of animal and vegetable kitchen refuse. The other principal items that make up the waste of the city are ashes and rubbish, the latter consisting of paper, bottles, tin cans, etc. Our incinerator handles all of this material without regard to percentages, reducing same to an innocuous ash. The average amount of garbage per day for an ordinary household is about 2½ pounds. In-

nicipality to war with contagious disease. The original cost may seem to some cities burdensome, but when it is considered how much is saved each year in the conservation of human life, etc., the initial cost may seem trifling. Each year municipalities expend large sums of money for the protection of property by means of suitable fire-fighting apparatus, station houses, etc. Is it not as reasonable to spend something on a municipal refuse disposal plant to protect life and promote comfort as well as protect property?

PHIL H. WEBER, City Engineer.
Canton, Ohio.

March, 1913.

Mixing Concrete in Winter Months

The Editor of MUNICIPAL ENGINEERING:

Sir—The question of mixing concrete in winter months is of vital interest to the contractor. There are several methods used in the cold weather each with its advantages and disadvantages. The only method which should be considered is that which produces uniformly high grade concrete.

Hand Mixing Inside of Buildings

Some contractors consider hand mixing the only method for use inside a building, but hand mixing is seldom allowed where there is an architect or inspector on the job. In the first place, the labor required to mix and handle concrete by hand is about 300 per cent. more than required by a mixer. Secondly, the concrete is not uniform and cannot be of the high quality which is required in building and reinforced concrete work. Very seldom is the concrete turned over on the boards more than about three times. Third; the freezing weather causes lumps to form in the sand and gravel which cannot be broken up by hand mixing. Fourth; concrete left standing on the boards for any length of time in freezing weather is a waste to the contractor, also poorly mixed concrete will not be accepted, which causes delay and waste to the contractor.

Mixer Mounted on Skids Placed Inside of Building

Up to date contractors consider this the best method of mixing concrete in the winter months and secure a simple mixer mounted on skids, with a low, wide opening in the drum large enough to permit it being charged by shoveling directly into the drum, or by the use of barrows from a low platform. This type of batch mixer, which has been on the market for only a few years, can be taken thru an ordinary door and placed anywhere inside the building. This is impossible with the old, heavy, complicated, side-loading or high-charging mixers. Concrete that is mixed by guess can not be uniform, therefore the opening in the drum must be large enough to permit inspection of the entire batch while mixing. By placing the mixer within the building the concrete does not have to be rushed from the mixer to the forms, as this simple type of mixer can be placed near enough to avoid this. As the temperature of the mix in the mixer is the same as in the forms there should be no checking or cracking due to sudden changes in the temperature.

Hot Blast Mixers

This type of mixer has an inlet thru which either steam or hot air is forced into the drum to heat the water and material. This is not only an expensive but dangerous method and has been only partially successful for a variety of reasons. The hot steam or air which is forced into the drum causes the material to expand and when the concrete is discharged the sudden change in temperature causes the material to contract. This results in checked and cracked concrete. The machine also suffers. The heated parts expand, and when the day's work is over they contract and often break the gear wheels or bands.

Mixing with Saltpeter Preparation

This method is adopted by many contractors who have a rush job in zero weather. The saltpeter is put in water to keep the concrete from freezing and to give it ample time to set. This method is very expensive and could not be used to great advantage on big jobs. The saltpeter not only keeps the concrete from freezing but tends to make the concrete set quicker. This preparation will build up the strength and life of the concrete, providing that great care is taken to get the right proportion in every batch.

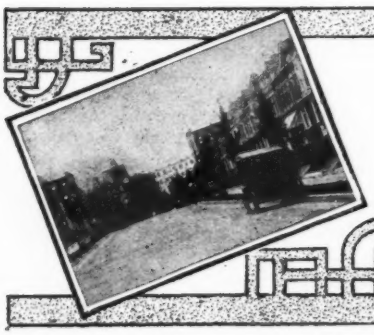
Heating the Material

No matter what method is used for mixing, certain steps must be taken to protect or thaw the material before using. The thawing of the material can be accomplished by using sand heaters, which are ordinarily round iron pipes, about 14 inches in diameter and about ¼ inch thick. The sand or gravel is piled around and over the pipe and a fire is built in it. Another good way is to pipe live steam from either the mixer or hoisting boiler, or from a separate boiler provided for this purpose. The placing of the materials inside of buildings in bins will keep it dry and very little thawing should be necessary unless the weather is severe.

Protecting the Concrete

There are several ways of protecting the concrete until it has had sufficient time to thoroly set. Many contractors heat their forms by forcing hot steam into the forms before pouring and then placing several layers of building paper over the exposed concrete on which is piled either straw or manure. If the weather is not too severe and the forms are built thick, this method will insure satisfactory concrete. If, however, the weather is below zero, the use of salamanders is necessary and the forms should be left on from five to seven days, according to the conditions. The contractor should consider the workmen in the winter months and if the mixer is placed inside of the building the workmen are protected from the extreme weather, the mixed concrete and material are protected from the snow and sleet, and twice the amount of high-grade concrete is turned out.

A. ———, Wis.



ROADS AND PAVEMENTS

Creosoted Wood Block Pavement in New York

Borough of Richmond.

"We have 16,500 lineal feet, aggregating 50,800 square yards of cresoated wood block paving in the borough of Richmond, city of New York," states Mr. Louis L. Tribus, consulting engineer and commissioner of public works of the borough.

"The location of this paving in this borough is upon the following streets: Canal street, from Wright street to Broad street. Canal street, from City Dock to Broad street. Richmond Terrace, from Ferry street to Railroad. Richmond avenue, from Richmond Terrace to Ferry Landing. Richmond Terrace, from Lafayette avenue to Harbor road. Water street, from Bay street to Wright street. Heberton avenue, from Elizabeth street to Post avenue. Heberton avenue, from Vreeland street to North end. Barker street, from Trinity Place to Castleton avenue. Jay street, from Richmond Terrace to South street.

"The above streets carry moderately heavy traffic and are in a less worn condition than other pavements laid at the same time. Aside from its noiselessness of traffic, creosoted wood block paving is to be commended on account of its low traction resistance, long life, small cost of maintenance and cleanliness. We have few complaints on account of slipperiness and during certain seasons of the year when all pavements are more or less slippery, we simply sprinkle sand or steam ashes on our wood block and thus forestall any possible trouble.

"Our specifications differ from the other boroughs of this city in specific gravity of oil, 1.03 and 1.08; also in the quantity of naphthalene and phenol acids.

"Above mentioned pavements are very sanitary because the creosote, used in

CREOSOTED WOOD BLOCK PAVEMENT *on Clinton Avenue, from Park to Willoughby Avenue, Borough of Brooklyn, New York City.*

treating the wood, contains a large percentage of highly antiseptic ingredients, namely phenol or carbolic acid and naphthalene. These ingredients are the lighter and more volatile portions of the preservative oil and continually comes to the exposed surface of the block, the only portions which collect germs, and thus evidently keeps the street in healthful, sanitary condition. The true cost of any pavement should not be measured by the first cost alone, but also the average upkeep cost per year and the average 'annual cost' should be taken into consideration in selecting an economical pavement."

Borough of Queens.

"Most of the creosoted wood block in Queens borough," states Mr. J. H. Weinberger, engineer in charge, "has been laid within the last eight years, altho in two instances it has been laid eleven years.

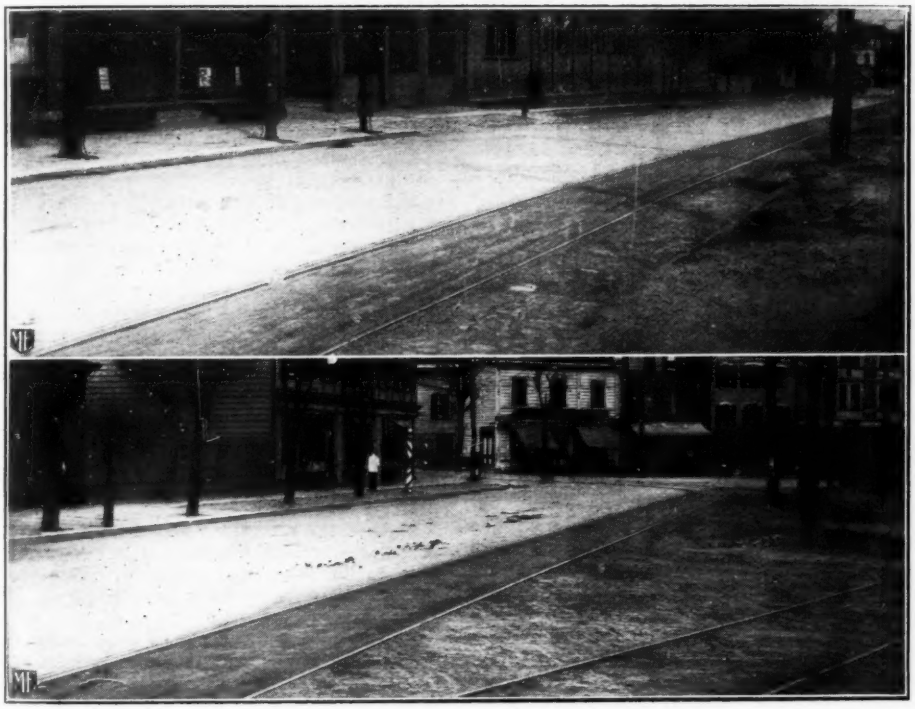
"I might add that the only cost on above streets has been such as was caused by the opening up of the pavement for house connections or other subsurface reasons and, therefore, the real maintenance cost to date has been nothing whatever.

"In the Borough of Queens, the following streets and parts of streets are paved with creosoted wood block:

Street.	Length.	Area in Sq. Yds.
Academy	930	3,133.58
Academy	998	3,485.30
Broadway	3,600	16,208.80
Bergen	1,440	5,101.39
Church	2,370	7,881.60
Front	370	1,230.18
First Av.	3,640	14,265.30
Jamaica	750	4,218.70
Lefferts	1,650	6,085.00
Metropolitan	4,180	12,165.00
Park	160	549.50
Second Av.	3,000	8,890.00
Sanford	2,840	13,058.40
Third Av.	3,000	7,782.90

"The above streets are in excellent condition and have been so uniformly satisfactory that in many instances property owners are petitioning for creosoted wood block for streets of both heavy and light traffic. As such improvements are paid for by assessment, the public authorities are glad to grant all such requests immediately.

"Creosoted wood block is noiseless and therefore especially desirable in both business and residential streets as well as all streets on which are located hospitals and schools. It is exceptionally easy to clean and keep in perfectly sani-



TWO CREOSOTED WOOD BLOCK *Streets in Stapleton, Borough of Richmond, New York City.*

tary condition at a minimum expense. In my estimation, this paving is the most sanitary in Queen's borough.

"When good blocks are used and then laid with great care on a good foundation and the proper precautions taken to keep it clean, creosoted wood block pave-

CREOSOTED WOOD BLOCK PAVEMENT *on Clinton Avenue, Brooklyn Borough, New York City.*

ments are bound to give universal satisfaction.

"People appreciate the uniform smoothness of this type of pavement and we have very little complaint on account of slipperiness.

"The specifications, as used in the Queens borough, are identical with those adopted by the board of estimate and apportionment for the entire city."

Paving in Trenton, N. J., Under the New Commission

By Harry F. Harris, Assistant Superintendent of Streets.

Trenton, N. J., a city of 100,000 population, has been under commission rule for just eighteen months, but during this brief period a great number of reforms have been accomplished along all lines, which seemed an utter impossibility under the old form of government, despite the efforts of well-meaning Common Councilmen and a number of municipal officers. Chief among these reforms perhaps are the strides in the Department of Streets and Public Improvements, especially along the line of street pavements.

In the first place the city was especially fortunate in choosing a civil engineer of considerable experience as the Director of the Department of Streets and Public Improvements out of a field of some sixty candidates. One of the first things which he set about doing was to thoroly reorganize his department, and begin a study of how to improve the old chaotic conditions which had previously prevailed, due principally to lack of a definite and systematic policy in regard to improvements.

As a result of this study the following

PARKSIDE AVENUE, *Trenton, N. J., looking north from park tunnel. Single course asphalt on corrugated concrete foundation, 5 per cent grade.*

innovations or reforms have been established, among others:

Employes placed under civil service.

City chemist employed to inspect thoroly all paving materials in addition to his other duties.

Patented pavements tabooed.

Discarded municipal asphalt repair equipment put in operation again.

Open specifications adopted.

Alternate bidding on all paving work.

Bids received on entire year's work in bulk, thus enabling the city to get maximum amount of competition.

City inspectors on pavements placed on merit basis. Those most efficient getting the most work, men being employed on per diem basis. Permanent new men to be chosen by civil service examination.

Fostering of a school which meets one night each week, where employes of engineering department get together and discuss technical and practical problems concerning the work.

System for recording street maintenance costs established, whereby it is hoped that a scientific local study may ultimately be made on the life and yearly costs of the various kinds of pavements.

City assumes the right to determine the kind of material to be employed in the paving of all streets.

PARKSIDE AND WHITTIER AVENUE *intersection, Trenton, N. J. Single course asphalt on corrugated concrete base.*

City refuses to either recommend or act on petitions for water-bound macadam streets.

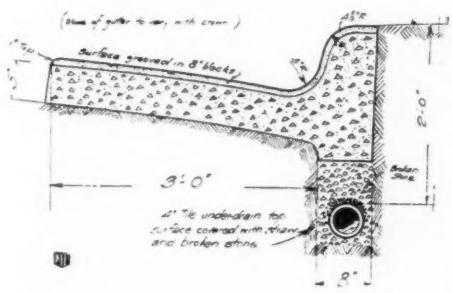
At first glance the above outline may not seem to be at all comprehensive or elaborate and it is not, except when viewed or compared with the old conditions. But it is one which must needs stand for efficiency, economy and progressiveness.

As a direct result of these policies, Trenton has obtained the cheapest and what they believe to be the best pavements ever laid in the city.

Bituminous Concrete Pavements

Some 25,000 sq. yds. of bituminous concrete pavements have been constructed for the sum of $1.27 per sq. yd., as against the price of $1.53 for bituminous concrete and $2.48 for bitulithic, which prices prevailed the year previous. This is believed to be a record price for anywhere in the United States, so far as we have been able to determine. The price includes excavation, a portland cement concrete base, 4

SKETCH SHOWING TYPE OF COMBINED CONCRETE CURB AND GUTTER USED IN SUBURBAN LOCALITIES.



inches in thickness, mixed in the proportion of 1 part cement, 3 parts sand and 6 parts washed river gravel or in several instances, crushed slag; a 2-inch wearing surface laid under the so-called Topeka specifications with the best Bermudez asphalt. Daily inspections were made at the plant, on the street and in the laboratory. This price per square yard includes the cost of setting all sewer manhole castings to grade and a 5-year guarantee.

Sheet Asphalt Without Binder

An experiment was tried in laying two sheet asphalt pavements. The streets in question were both in residential sections and it was decided to try out the plan of laying sheet asphalt, eliminating the binder course, and substituting therefor a corrugated concrete base after a method recommended by the engineer of streets. These indentions in the concrete were made by means of a specially constructed tamper having a number of triangular shaped extensions upon its working surface, spaced about 4 inches apart, each extension being ¾ of an inch in height and about 12 inches in length. The streets upon which this form of pavement was tried each had a 5 per cent. grade, a most trying condition one must admit, for this type of construction. These two pavements were built for the average price of $1.38½ per sq. yd., which price included 5-year guarantee, excavation, a 4-inch concrete base, and a wearing surface 1½ inches in thickness of Bermudez sheet asphalt. The thickness given does not include the material driven into the ridges of the concrete by rolling.

Concrete Pavements

Concrete pavements have been given a try-out on three alleys and a short street which gets considerable traffic. The concrete has been laid with the single and double courses. Prices, including excavation and 6 inches of concrete, have ranged from 90 cents per sq. yd. to $1.44. Wood expansion joints were used.

Gutters on Asphalt and Bituminous Streets

In view of past experiences in getting asphalt to withstand the effects of water, concrete gutters, sometimes as wide as 3 feet, or brick gutters about 18 inches in width were used in connection with all sheet asphalt or bituminous concrete work.

Sheet Asphalt

Only one street was constructed of sheet asphalt under the standard method and this was a street which was traversed by a double-track trolley line, making the work somewhat more difficult to handle, but this was laid for $1.61 per sq. yd., as against the price $1.98 the year previous. Prices include excavation, 4-inch concrete base (1:3:6), 1-inch binder, 2-inch wearing surface, Bermudez asphalt and 5-year guarantee.

Brick

Vitrified block pavements laid under the Standard Specifications adopted by the American Society of Municipal Improvements, requiring a 20 per cent. abrasion test (new rattler), have brought brick pavements to between $2.23 and $2.28 per sq. yd., using Metropolitan block. Price includes excavation, 4 inches of concrete foundation (1:3:6), slag as the coarse aggregate, 1½-inch sand cushion, cement grout. The abrasion test required, while quite severe, has been adopted with the view of getting the very best block obtainable.

One has to take but a look backwards at some of the old conditions, where spirited competition was throttled; where inspectors were appointed by politicians, re-

gardless of ability or qualifications; where paving petitions were circulated in numerous instances by representatives of paving companies, ofttimes specifying particular pavements entirely unadaptable to the streets on account of traffic conditions, grades, cost, etc.; where the use of antiquated, obsolete and at times closed specifications prevailed; where the city was constantly being burdened by spurious patented pavements, some of which would not outlast the guarantee; and the utter lack of facilities at hand for rigid and thoro inspection of materials at paving plant; and still a dozen other ways by which efficient, economical and businesslike administration of public work of this nature was an impossibility, all of which, when compared with the results obtained during the first season under the new regime is something which must make the average citizen feel just a little elated or feel that some headway for the cause of good government has been made.

It has been estimated that some $15,000 has been saved, based upon the figures which obtained prior to this season, and not only was this season's work completed at considerable saving and without a decrease in quality, but it was accomplished in record time, due to the fact that the contract was let in bulk, and that a competent contractor with a good organization was able to undertake and handle the work in a systematic manner.

Such is a brief resume of what has been wrought in Trenton in a few month's time, and which may be done, in the writer's opinion, in perhaps any other municipality under similar conditions at the expenditure of a little energy and effort on the part of some public spirited citizens, looking for a just and sufficient return for their money.

A Sample Concrete Country Road at La Salle, Ill.

At the close of the recent Springfield Good Roads Convention, Mayor Thos. F. Doyle, of La Salle, headed a delegation from that city in conference with the Illinois state highway commissioners, on the question of building a permanent roadway from the Rock Island depot at La Salle to a point one mile south.

Plans and estimates for the work were prepared by the state highway engineer and were laid before the La Salle board of highway commissioners early in February. Meanwhile, interest in the project was aroused among the producers of roadway material in the state.

F. W. Renwick, president of the Joliet Sand and Gravel Company, Chicago, considered the enterprise a laudable one and consented to furnish free the gravel, consisting of approximately 2,800 tons, or 95 carloads. The Marquette Cement Manufacturing Company and the Chicago Portland Cement Company, Chicago, demonstrated similar interest, and will jointly furnish, without cost, the cement required, amounting to 26 carloads. The American Sand and Gravel Company, also of Chicago, stands sponsor for 54 carloads of sand, which will be shipped as required from sand pits at Buda and Lincoln.

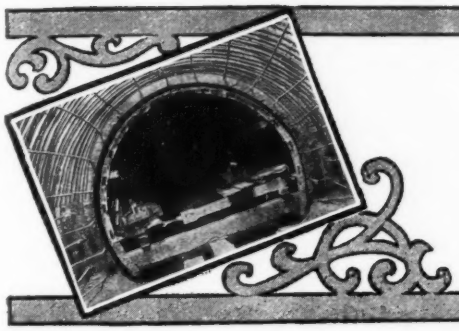
At a meeting of the La Salle board of highway commissioners, held at La Salle on Wednesday, February 5, letters were read from the donors and their respective offers were formally accepted, the board appropriating the sum of $5,000 to defray the cost of labor and fuel incidental to the work.

The Illinois highway commission at Springfield were then petitioned to supervise the building of the road, and in granting this request the state highway engineer named May 1 as the date on which the work will proceed.

The specifications of the state highway engineer call for a roadway nine-tenths of a mile long, 20 feet wide, with an average thickness of 7 inches. It will replace the old road at a point where it is subjected to heavy traffic, La Salle being the most convenient market for the prosperous farming community immediately south of the city, which must necessarily travel this highway.

The old road is in very bad condition, and has on that account been a source of complaint among farmers, hence the activity of the La Salle board of highway commissioners, who now express keen satisfaction in the rapid culmination of their plans for the replacing of it with a permanent highway of the most approved type.

The generosity of a number of Chicago business men, who, in donating the materials, have thereby contributed 60 per cent of the cost of this roadway, is also a source of gratification to the citizens of La Salle and vicinity generally.

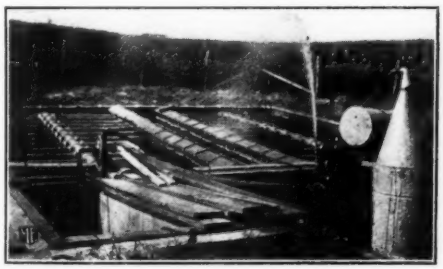


SANITATION

Cleaning the Sewage Tank at Galva, Ill.

By Lloyd Z. Jones, City Engineer, Mem. Ill. Soc. of Engineers.

The south sewage purification plant at Galva, Ill., was built in the spring of 1910. The plant consists of a sandbox, tank 10 feet wide and 30 feet long, with sewage 7 feet deep up to outflow towards filter beds, which are about 16 feet by 34 feet each, with alley between. An 8-inch intercepter tile from the lowest manhole on the sewer system leads up to a 20-inch drainage tile, which carries sewage from the worst producing plants of the sewer district. This intercepter coming under the drain, took all the flow up to the capacity of the 8-inch tile, and only when a large amount of storm water came, did it fail to get all the flow. Consequently this purification plant got sewage and all the street-washing, and dirt, when there was a storm.



CLEANING *Septic Tank at Galva, Ill.*

The sewer system was put in in 1911, but few connections were made that year. After hearing that plants at Wheaton and Urbana had not been working satisfactorily, I examined the tank and found a growth of sludge stiff enough to bear up a tile scoop 2½ feet above the bottom of the tank, if carefully lowered, but not dense enough to prevent the scoop being readily moved around in the sludge. This matter was at once reported to the council meeting, with the statement that it had cost Wheaton several hundred dollars to clean their septic tank. Galva is a new city, and like the man with a new watch, they forgot to wind it. By August it had become so bad that the street boss could get no discharge when he opened sludge valve. But later, when some scavengers were going to clean the tank, the valve was opened, and the tank full discharged. The sludge was 3 feet deep after much of the water had drained out of it.

The scavengers, working by contract, got down in the bottom of the tank on a large box and took out with a rope and bucket, two barrels of sludge, and then disappeared from town. The tank stood empty about a week, with the sewage running directly thru, when the sewer committee of the city council ordered the valve closed, so that the tank could fill. Later they talked with the city engineer, and got him, one Lloyd Z. Jones, to see if he could clean the tank.

In the meantime the sludge had dried and become solid enough to require considerable push on a 2 by 4-inch to make it go to the bottom. We had at our house an American Well Works centrifugal pump, 1½-inch size, and a 4 h. p. Cushman engine, with which we were accustomed to irrigate potatoes. A short piece of iron pipe was drawn down to a ¾-inch nozzle, a tee screwed on, a 16-foot length of 1-inch pipe screwed into the side connection of the tee with an elbow at the top and a 2 or 3-foot piece of plugged pipe at the top end for a handle, parallel to the nozzle, to show the direction of the jet of sewage. Short lengths of pipe increased to fit 1½-inch hose were connected by hose to the pump discharge. Several small ropes were fastened to the hose, with which to place the hose about on the bottom of the tank, and one rope on the lower end of the suction pipe. The 2-inch suction pipe with check valve was long enough to reach from the pump on the edge of the tank to the concrete at the bottom. When stirring up the solidified sludge, the suction end was drawn

up to just below the top of the sewage. Then the pump, throwing somewhere from 80 to 100 gallons per minute (force enough to throw a ¾-inch stream of water the whole length of the 30-foot tank, in air) was started, and the nozzle was pushed to the bottom of the tank, turned and moved back and forth across the tank until the whole tank was loaded with all the black roil it could carry. Then the suction was dropped to the bottom of the tank, and the discharge carried over the top to a ditch filled with brush, and covered over with dirt. At other times the sludge valve was opened a little more than the inflow of new sewage, and the jet kept running until the tank was emptied, then the work was stopped until the tank filled again.

When we started on the job, we found the alley between filter beds filled about a foot deep, with black, shiny "buggy-paint." We ran the hose and jet down into the alley, and washed it out clean. Twice afterwards we opened the sludge valve to empty the tank quickly, after we had stirred it up, and each time we got the alley filled again as at the first time. Then we thought of the only one of Josh Billings' sayings we could remember, "If a man cheat you, blame him, if he cheats you twice, blame yourself." It seems that the half mile of 10-inch discharge pipe had become nearly filled with the lighter sludge oozing out of the tank the days when the tank stood empty, when the scavengers were supposed to have been at work. So that when I would open the sludge valve the sewage could not run away fast enough but what it would back up under the filters.

We fitted some pipe so as to extend the pump discharge down into the outlet below the filters. Then we wedged the 10-inch outlet as near water-tight as we could, and with the sludge valve shut, we pumped 100 gallons per minute into the outlet tile, and it had to get somewhere. The clean sewage from the top of the tank got the sludge to moving, and scoured out the whole half mile, without any more bother.

A large piece of ¼-inch mesh wire cloth was rolled and fastened outside the check valve to keep away anything to stop the check valve inlets, and watermelon seeds were the only thing which gave any trouble.

The tank is faulty in design, as the bottom of the sludge valve is 13½ inches above the bottom of the tank, and it can not be emptied without pumping. The tank will never be able to do its best work with sewage so long as it has to "digest" that 8-inch intercepter tile full of storm water and street washings, and worse, the storm water, rushing in with a head of water above the inlet of the intercepter, has carried sludge to the farthermost distributing tiles on the filter bed, so that they were 1/3 full of dry sludge. This sludge ran clear down thru the filters, partly choking them, and made a 3 or 4-inch deposit in the conduit tiles under the filters. Some of the weeds growing in the filters were taller than I am.

We had great luck cleaning the dry sludge from under the beds. We led our pump discharge down between the filters, and inserted the nozzle into the conduit tile openings, and found we could throw a stream clear back to the end of the 15-foot passages, and could clean out one on each side of the jet with the back flow at the same time.

When we first began to work in the tank, I noticed a peculiar color in the sewage at the other end. Upon going there, and looking closely, the color was found to be caused by wiggle-tails (mosquitoes). I think that there were 100,000,000 of them. I told the council that I knew now why the people on the south side had such a scratched-up, pimply appearance, it was caused by mosquitoes raised in the south septic tank.

Soon after the tank was cleaned and filled, hundreds of black, floating rafts of mosquitoes' eggs were seen. There are from 200 to 500 eggs, standing on end in each float. No mosquitoes were seen until 5 or 6 o'clock, when they poured out of the filter beds like bees. Two quarts of kerosene the first time, and about a quart a week after that, kept the wiggle-tails out of the tank. If these, in hatching into mosquitoes, do not carefully wipe their feet and bills before leaving the surface of the sewage, it is readily seen how any disease germs, carried by the sewage, can be quickly spread over the whole town. There is more food for mosquitoes in a sewer tank than in forty acres of stagnant pools, which the health officers so diligently kerosene.

Sometime after the tank was cleaned, it was observed that the regular sewage flow had ceased. Search at the first manhole above, showed that there was no flow. Then the ground was prodded with a rod to find the intercepter in the 20-inch combined storm water and sewage drain. When found the plank roof was completely rotten, ready to take in a horse and give the city a damage suit. A good stream of sewage was going down the drain. An iron prod brought up two old shoes, and we do not know how many got away, but the sewage began to go towards the tank again.

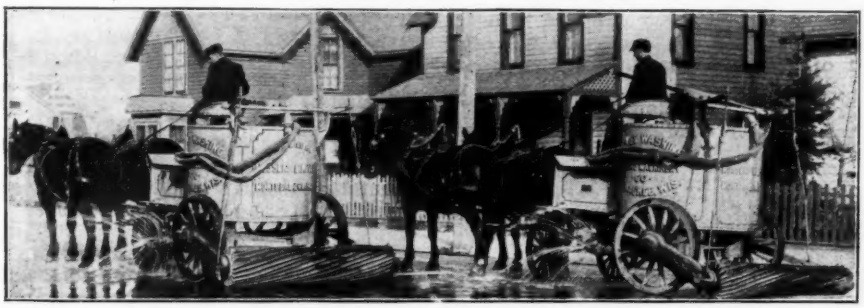
The sanitary sewer entering the manhole with the intercepter was found to be two-thirds filled. A hose attached to a hydrant at the upper flush tank fifteen minutes scoured out the sewer, and then

we were able to see that the mischief was done by the intercepter. The intercepter discharge runs across the manhole at right angles to the sewer, and when the intercepter is running full of dirty street storm water, it deposits a sand bar in the end of the sewer outlet, and there not being enough flush tank water to remove the sand bar, there was a back-up of solid sewage. The intercepter should be enough lower than the sewer so the outfall will be kept clear.

This was practically a one-man job, the engine and pump could be loaded by one man, and the attempt of the ¾-inch jet to travel backwards was overcome by holding against the bottom, or prying against a plank, with the 16-inch pipe handle. With this outfit the tank could be cleaned by a person with his good clothes on. I had such good luck that I did not have to give my wife the money I received for the job in order to come back home. If all the sludge had to be taken out over the top of the tank, probably the quickest way would be to have two pumps, one with a double jet, and the suction of the discharge pump placed in between the two jets, so that the scourings would be sucked out as soon as made, and the tank cleaned without being emptied.

cared three whoops whether they had a $250,000 court house or transacted their legal business in a cellar. Of all the foolish ideas that ever possessed a community, it is the notion of spending loads of good money for unnecessary, ornate city buildings to "boom the town," and then neglect the condition of the streets and alleys. The average stranger who has seen fine architecture by the mile is not likely to be vastly impressed. He is impressed, and most favorably impressed, by filthy streets.

We are very jealous of our good paving in Calgary and make every effort to keep it in a cleanly condition. On our rough streets we use high pressure flushers, which carry as high as 80 pounds pressure received from the hydrants. These flushers commence their work in the center of the street and force all refuse, dirt, etc., to the gutter, thus sending the matter gathered to the catch basins, located at every street corner. We find this system most satisfactory on rough pavements, such as granitoid, and other paving having indentations on the surface. These flushers are used almost entirely during the night. During the day Kindling squeegee machines are used in the uptown district. These machines,



TANDEM *Method of Sprinkling and Washing Streets in Calgary, Alberta.*

Street Cleaning in Calgary, Alberta, Canada

By W. H. Cuddie, Superintendent, Street Cleaning Department.

I have seen many towns over the country with, I will say, from 25,000 to 50,000 population, where the merry villagers have taxed themselves for fine and modern pavements and then allowed them to become buried in mud. In some of these towns not a solitary merchant in the place has energy or ambition enough to hire some cheap worker to get out with a shovel and broom and clean up the middle of the street near his store. Some of the same towns would probably spend several thousands of dollars on a fancy court house, just as if a visiting stranger

we find, do their work in an efficient manner. On street ends, during light snow or rain storms, we resort to cane and bamboo-filled horse brooms, which we refill ourselves. Of course, ordinary street sprinklers are sent ahead of these machines to flush the roadway. In our subways we use fire hose and heavy pressure water for cleaning purposes and find the system to be most satisfactory.

Our squeegee machines are giving excellent service. This machine is a combined sprinkler and cleaner as it sprinkles the pavement and cleans it at the same time.

The consumption of water is extremely small for the results attained. There is no waste, but practically every drop is caught up by the squeegee as it washes

the pavement. Tests and records of water consumption extending over long periods show consumption of slightly over one pint per square yard of pavement cleaned.

I would also like to call your attention to the fact that our street-cleaning system, as well as all departments, are municipally owned, controlled and operated. In the street-cleaning department, all the horse and other motive power required is taken care of in the large city stables.

The Meterage System

The Editor of MUNICIPAL ENGINEERING:

Sir—Wasted water obviously serves no useful purpose, but proves a source of profit to the city when it is allowed to remain in the reservoirs until required. It also saves in operating expenses the entire sum required to pump, filter and distribute it. The cost of installing and maintaining the water meter system is less than the cost of additional pumps, filters, mains and other equipments which are not needed when the meter system is installed.

In no more forceful manner can the water meter system demonstrate its value as an economical factor of water works management, than when it shows the exact quantity of water supplied to every consumer. In this it performs the function of an individual bookkeeper where records cannot be questioned.

The general extension of the meter system in the city of Milwaukee was not introduced until 1887. At that time there were only 871 meters in service and the daily per capita was 113 gallons. With the general introduction of meters the per capita gradually became less each year until 1901, when it reached the low figure of 80 gallons. Since then the per capita has steadily increased and for the year 1912 has again reached the maximum of 113 gallons. This is of no special significance and no reflection on the meter system, as the large manufacturing industries of this city and suburbs are using more water each year without a corresponding increase in the number of consumers.

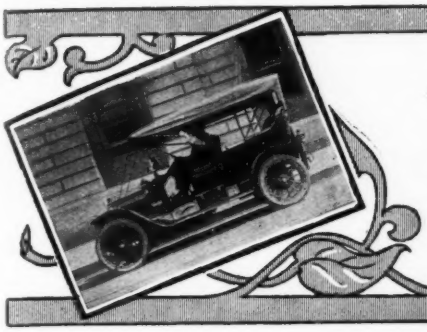
We have a number of consumers who pay all the way from $25,000 to $50,000 annually. We have a total of 58,500 consumers and out of this number less than 100 pay nearly 50 per cent. of the entire water assessment. If we eliminate the water furnished to the 100 large consumers, the daily per capita for the remaining consumers will not exceed 82 gallons. This result could not be accomplished without a general introduction of meters. Owing to the general introduction of meters, the department was able to account for all but 18 per cent. of its total pumpage for the year 1911, the metered consumption alone being over 62 per cent. of the entire pumpage. The figures for 1912 are not quite ready for publication, but undoubtedly the unmetered water will be less than in 1911. The revenue per million gallons pumped has increased 89 cents as compared with 1911. Out of the 58,500 consumers there are only 800 unmetered.

Type of Meter Used in Milwaukee.

A house to house inspection was made recently of the unmetered services and it was found that in many instances large quantities of water were being used in excess of the water reasonably required and in excess of the amount which consumers were entitled to under the flat rate. In many instances consumers were wasting at the rate of $200 to $500 a year on an annual payment of $8 to $10. Out of a total of 975 unmetered premises, 175 were ordered metered, where the department had positive evidence of wastage or leakage. As the department desired very much to have the remaining 800 unmetered services controlled by meters, the department made application to the Railroad Commission for the necessary authority. In a formal order the Railroad Commission authorized the department to require the installation of water meters on all premises not supplied with meters. This will go in effect May 1, 1913, and the department feels certain of a still greater reduction in the unaccounted water. This department has always taken the attitude that the method of assessing water by meter is the only fair and equitable basis, not only to the water department, but also to the consumer, and has used every effort to obtain universal meterage.

The water meter system stands today after many years' trial in all sections of the country, as an unequalled source of permanent economy in water works management. It secures the lowest operating and maintenance cost, at the same time guaranteeing the just and full returns due the city for the sale of its commodity.

HENRY P. BOHMANN, Superintendent,
Milwaukee, Wis., Water Works.



Automobiles in Municipal Service

Controlling Use of Department Automobiles

By James Reed, Jr., Assistant Director of Public Works, Philadelphia, Pa.

Six touring cars and one runabout are attached to the city hall in this department. There are five runabouts detailed to highway and street cleaning district offices. The former are operated under a pooling system. On file in this office is

Dept. of Public Works

DAILY REPORT of CAR D. 40 Cole

Date Dec 11-1912.

Time			Speedometer			Used by (Full Signature)
out	in	diff	out	in	diff	
8 30	9 30	1	7387	7405	18	Geo Ent
10 30	11 55	1 25	7405	7411	6	Odell
12	2 50	2 50	7411	7423	12	Geo Ent Datana
3 10	5 00	1 40	7423	7440	17	E J Gibbs
Total Time	5 30		Total dist		53	

Gasoline Gauge: Out_____ In_____ Diff_____

Gasoline Received—None—Gals. $_____

Oil Received—None—Pts. _____

Miscel. Supplies—_____ _____

Miscel. Repairs—_____ _____

Total Expense—_____

Remarks:-

Signed—_____

ME W. J. Tiebton—Chauffeur.

Form of Daily Report of Use of Automobiles, Philadelphia Department of Public Works.

March, 1913.

an approved list of those officials in the various bureaus who are authorized to request the use of a car. These requests are made in advance by telephone or in writing, to a clerk who has charge of the movements of the cars, and he details for the time specified a car of sufficient capacity to answer the requirements. The chauffeur is required to enter, in a record book carried in the car, the speedometer reading and the time on reporting and on being discharged, and the official using the car must sign opposite these entries. The chauffeur is also required to enter the amount of oil and gasoline taken during the day, any repairs, accidents, etc. These sheets are turned in daily and the various items transferred to a monthly summary sheet, which shows the cost of operation of all the cars in the department. All supplies are now purchased at wholesale prices and most of them, including tires, gasoline, etc., under annual contract.

In addition to the above, a careful tire record is kept on a tire record sheet (copy herewith), which shows the original cost of purchase, manufacturer's number, repair cost and total mileage of every shoe on every car in the department. In this way careful and accurate comparisons are available between the mileage obtained from the various makes of tires. All purchases are made on requisition order forms from this office, which must bear the signature of the assistant director, and the bills are O. K.'d by the chauffeur of the car for which the article was purchased and also by the head chauffeur as a check. They are then charged at the time of payment against the proper car, under the proper item.

You will be rather interested, I imagine, in noting the actual operating cost of the various cars for the year ending December 31st, and I am therefore attaching a summary sheet hereto which gives this information. You will note that the cost of operation and maintenance, including chauffeur's wages at one thousand dollars a year, and storage charges, averaged much lower than the

usual cost per mile to the private owner for cars of similar size and power. As of interest in this connection, I am also transmitting copies of the various orders under which the cars are operated.

The advantages of the system of control which I have described above are plainly evident, when you compare the cost of operation under this scheme with the operating cost under the previous administration. There is, of course, the additional advantage that the efficiency of the higher officials of the department is enormously increased by enabling all of them to have the use of the cars for inspection and other official duties. This applies particularly to the engineering bureaus—water, surveys, gas and lighting, and highways and street cleaning, and each car is no longer regarded as more or less the private property of some official.

In the tabular summaries of car cost above referred to one set gives the totals for each month for each car in use; another the monthly totals for all cars in use and the annual total; another the monthly and annual totals for each car separately.

The annual totals are given in the accompanying table for 1912.

Cars A and E ran for the whole year. Mileage and hours of service were not reported prior to July 1, and the mileage of these two cars prior to that date is computed on the basis of 8 miles per gallon of gasoline used.

Cars B, C and D were started July 1, and car F, September 1.

Mileage and hours are given in the table to the nearest unit to save space.

Additional equipment is not included in the cost per mile.

The detailed tables of which the table given shows only the totals, show great variations in mileage of cars per month, from zero in August for car A, followed by a repair bill of $240 in September, to 2,088 miles for the same car in May with a cost for repairs of $5. The cost for repairs is insignificant except for the two cars which ran the whole year. The average mileage per car per month is also somewhat variable, dropping down for the month that new cars were put on below that of the month before. It ranges from 994 miles in September, with six cars in operation, one for part time, to 1,706 in November, with six cars all running full time. Assuming 312 days in the year, the average mileage is 48.5 per car per day. The actual average mileage of cars in commission is probably a little larger than this, for in the computation, all cars were considered to be in commission all the time except one car out for the month of August.

TOTAL COST OF EACH CAR IN USE FOR ALL OR PART OF 1912.

Car	Miles	Hours	Gasoline		Car Cost in Dollars								Cost per Mile, Cts.	Add. Equipment, Dollars
			Gals.	Per Mile	Wages	Garage Storage	Tires, Tubes Replacements	Gasoline	Lub. Oil Grease	Repairs	Misc.	Total		
A-40 Knox..	15487	....	1722	.11	916.67	165.00	679.84	259.45	11.72	325.42	19.07	2377.17	15.3	81.96
B-30 Loco..	6804	833	686	.10	391.06	105.50	107.94	105.53	9.77	2.25	6.00	728.05	10.7	167.45
C-40 Cole...	9075	1075	821	.09	475.66	112.50	181.68	125.28	5.91	.....	1.13	902.16	9.9	265.95
D-40 Cole...	7699	937	778	.10	413.55	96.50	144.57	118.13	6.12	.....	1.80	780.67	10.1	203.25
E-30 Garf..	12591	....	1459	.12	1023.83	166.50	332.17	219.62	8.02	142.31	10.13	1902.58	15.1	51.05
F-30 Loco..	5151	486	516	.10	255.59	45.00	113.78	79.97	3.00	4.00	.70	502.04	9.7	44.08
Totals ...	56807	....	5982	.10½	3476.36	691.00	1559.98	907.98	44.54	473.98	38.83	7192.67	12.7	813.74

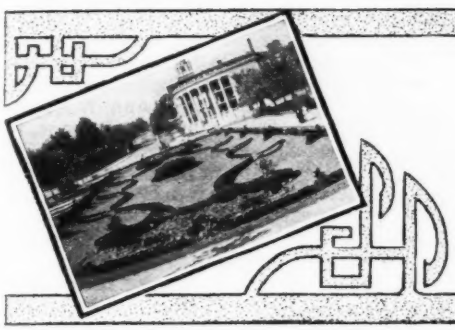
Following are from some recent letters of instruction to chauffeurs:

"Whenever it may become impossible for you, on account of sickness, or for other good reason, to report for an assignment at the hour named, you will please notify this office within time sufficient to permit of the assignment of another chauffeur in your place. And whenever you may be unable to report to the garage at the regular hour, you will also so advise this office."

"Hereafter, when any expenses are to be incurred in connection with any of the cars of this department, the chauffeur will report the fact to John Markley, chauffeur director's office, who will act as head chauffeur for the department. He will investigate the necessity for incurring the expense and will report to me whether any purchase or repairs are necessary."

"The cars of the department will not be taken out for service except on assignment from this office. When returning from an assignment you will report to Mr. Smarr, and if other instructions are not given, you will return to the garage, to await further assignment.

"Please keep correct records of all gasoline and oil used by your cars."



CIVIC BEAUTY

Public Sentiment Effects Civic Improvement

By A. W. Grant, Fort Worth, Texas.

ALL civic improvement workers are familiar with the importance and uses of public sentiment. But a serious study of this asset on the same basis as one would devote study to the treatment of a city's physical assets in preparing an improvement scheme is not so common.

Are we to leave the molding of public sentiment and using it to the best advantage to the personal tact of individual workers, or is there any way to go about determining relative values as one would prepare a formula for road material, or outline a scheme for municipal accounting?

It is the purpose of this article to raise an inquiry rather than to answer these questions dogmatically. That the inquiry is an important one has been felt, no doubt, by every civic improvement worker whom circumstances placed in a strange city and gave the task of directing that city's energies in the right direction.

It is easy for the professional city builder to say "Do thus and so" and often, from his experience, he can give valuable suggestions as to "how" the suggestions can be carried out with a minimum waste of energy. Yet we know the formula for an old and conservative New England town cannot be the same as for a bustling city of the new West; that ideas found efficient in a northern city may show a baffling failure to take root in the South.

For purposes of definition may it be said that the writer conceives civic improvement to embrace all works towards increasing efficiency in the management of municipal affairs and increasing the comfort, safety and enjoyment of a municipality's citizens.

This definition is rather large and since the different kinds of work it embraces generally fall to specialists it is apparent that the uses of public sentiment are equally varied.

For instance, in one city there may be no difficulty in obtaining the backing of public sentiment for a system of parks and boulevards, but to attach that sentiment in behalf of improved sanitation may be extremely difficult. We may find localities in which everybody seems in favor of more paved streets and better lights, but the vast majority of citizens are indifferent to a uniform and business-like system of handling municipal accounts. We find cities in which there is an overwhelming sentiment for better water facilities, but a strange neglect of fire prevention ordinances, in spite of the fact that a reduction of fire risks is one of the surest ways of increasing water supply efficiency. When a town finds itself in the conflicting currents of rival specialists each claiming his work as most deserving of public attention, then the waste of energy in the use of public sentiment becomes enormous.

For public sentiment is an asset as distinctly as a city's reputation for meeting its obligations is an asset; and it has a value as certain as the city's taxable properties.

Civic improvement work in any city generally presents three periods which, in the haste to make a showing, are sometimes overlooked. These three periods fall into the following classifications:

(1) Reform of past mistakes. (2) Work for present accomplishment. (3) Plans for systematic growth and development.

Obviously we cannot achieve success by starting with a scheme for future development and neglecting the reform of past mistakes. On the other hand, it is too frequently noted that in "reform waves," with which every city is familiar, there is a complete neglect of plans for systematic growth and development so that after the reform period, the city lapses into its old conditions.

The first step towards making public sentiment available for any work is un-

doubtedly the obtaining of confidence. The individual merchant finding himself in financial straits goes for help to the bankers in whom he has confidence. And frequently the banker is not worthy of it. That is, while he may willingly assist the straitened merchant out of his immediate difficulties, he has not performed the most valuable service, unless attached to the financial help he has given personal service in studying the causes that led up to the difficulties and outlining a course, by following which the merchant can avoid future disaster.

In this respect cities are like individuals. We go, in times of doubt, to men in whom we have confidence. Generally this confidence has little foundation except the reputation of the man consulted. We get into a municipal mess and then, when no other salvation offers, throw ourselves at the feet of one or more municipal experts and trust them to save us. And the public, mildly interested, trusts to the selection of its reform administration, or its "committee of citizens" and proceeds to go about its business, unless the experts, thus appealed to for help, have an appreciation of their responsibility to obtain public confidence to a degree much greater than that which merely lets a man alone to do his work without interference.

How often do we hear of a municipal accounting expert, called in to untangle a city's finances, going before the labor unions of the city where he is employed; to the federation of churches; to the women's clubs, and talking seriously and frankly upon the importance of business-like methods in handling a city's business? Not often.

Quite likely the expert on municipal finance is a worker and not a speaker, but that does not prevent him getting some one to create publicity, not for his personal advantage, but for the importance of his work. Public confidence is not to be obtained either by merely making a speech to the city council, or even a mass meeting of citizens. It calls for taking the work to the citizens in surroundings where they feel at home. The average citizen is not at home in a mass meeting, but find the same man in his office or in his church where he goes every Sunday or at the lodge room where he may be found every Friday night and you have him in an atmosphere where he is at ease and is prepared to listen.

Every allied interest of a municipality's citizens is worth being appealed to in order to obtain confidence. Perhaps it is drawing this proposition too far away to say that the water supply expert should spend thirty minutes valuable time discussing water supplies with the switchmen's union or at the Sons of Hermann picnic, but if an unshaken public confidence is to be obtained somebody must do just this kind of work.

And the first step is for confidence, not support, assistance or enthusiasm. Better to face a public heckling and meet all the possible opposition at the very outset, than to undertake any great work in which public sentiment is an essential to success, with a majority of the citizenship uninformed and indifferent to its importance.

In obtaining confidence an intelligent presentation of the need for the three steps already outlined will appeal to the intelligent man and serve as an excellent safety-valve for the too enthusiastic citizen. For over-enthusiasts are common and sometimes they are noisy enough and have following enough to keep opening the oven door while the cake is baking and seriously affect the results.

An effective way of dealing with the over-enthusiastic class is by providing a harmless safety valve. If a big park and boulevard scheme is under way, calling for years of work, an easy outlet is the beautification of some tract not interfering with the general scheme which may be made as elaborate as the most enthusiastic may wish. If a sanitation scheme is being worked out, the energies of the enthusiasts may be directed into a sanitation census, a listing of property owners willing to install city connections. The experience of any expert will furnish suggestions for whatever safety-valve of this kind may be needed, but provision of such outlet is not needed many times when it seems called for. A clear presentation of the importance of intelligent order in the progress of any civic improvement task should be made to the enthusiast. They are already confident and are ready to be enlisted as workers.

The molders of public sentiment are infrequently those whom the worker for civic improvement will not naturally encounter. Sometimes they are relatively obscure. The president of the women's federated clubs may not be nearly so efficient as a public sentiment molder as some member who holds no office. It should be the business of the man who expects to depend on sentiment and use it in his work to seek out the sentiment molders. Perhaps some of these are unconscious of their power. It is not always the one who can make the best public address who commands the most confidence. In a bank panic a few years ago the banks of a comparatively small city were in danger of failing together. The officials who had obtained the largest share of public attention by frequent quotation in the press and by identifying themselves with a great variety of movements were helpless to stem the tide of

public opinion to the effect that all the banks were unsafe. So in desperation they turned to one of their number who, for forty years, had, almost unconsciously, been building up a reputation for simple honesty. People who had never seen him knew his reputation for an "honest man." He was prevailed upon to make a statement for publication. It was about twenty-five words long and was to the effect that the banks of the city were sound. In a day the public sentiment shifted and the banks were saved from disastrous runs.

Frequently a few words from these quiet people have tremendous weight. The worker for civic improvement needs to study such assets and win them to his purposes.

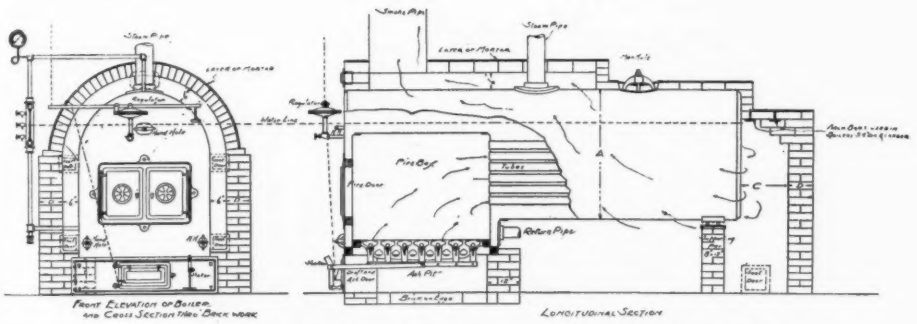
No commentary upon public sentiment is complete without reference to the uses of the public press. The phrase "editorial support" is a vague one and frequently misused. The civic improvement worker who finds his project flattered in editorial columns but neglected by the reporters may sometimes be tempted to believe that editorial praise is more damning than helpful. The co-operation of every department of a newspaper is needed; editorial, reportorial and business office and with all three working together the press becomes a power.

The various stages of public sentiment as a tool to aid in civic improvement appeal to the imagination; as a hammer to pound its way thru opposition; as a wedge to pry into difficult obstacles; as a stimulus to energy when the way seems difficult; as a balance in which may be weighing opposing opinions when conflict between authorities seems imminent; as a forge to keep hot the purpose of the work—public sentiment may be made to serve in all of these capacities. And the civic improvement worker who aims for success does well to remember that public sentiment is a good servant, but a bad master. Does it not then, pay to study it, probe into it thoroly in every community, and make a careful survey of its possibilities at the outset of any big municipal task?

Smoke Abatement

A bulletin issued by the Federal government has high praise for Chicago's efficient fight for the suppression of smoke. Existing conditions are contended with by the city authorities under an ordinance which has been copied by several cities. The analytical study of the great problems, conducted on a scale never before attempted in any city of the world, is in the hands of the committee organized thru co-operation of the city, the railroads and the Association of Commerce, namely, the Committee on Smoke Abatement and Electrification.

"Although there is to-day in Chicago an immense amount of coal smoke from all sorts of furnaces," the Federal bulletin says, "there is certainly no other American city that has made such marked progress toward the scientific solution of the smoke problem. Smoke abatement in Chicago, more generally than elsewhere, has been recognized and attacked as an engineering problem."



SECTIONAL VIEW *of Kewanee smokeless firebox boiler.*

While figures are not available for an exact comparison, the recent reports of Chicago smoke inspectors give gradually lowering averages of smoke production, but the higher figures of the special engineers employed are held to be the result of a most exhaustive investigation, substantiated by voluminous records giving one-minute interval observations for every half mile of the territory under study.

The method has been to station observers at an average distance of one-half mile apart along the line that may be under observation at a particular time. Every effort is made to keep the knowledge of the presence of the observers from

the operators on the lines, lest such knowledge would have the effect of producing improved performance. These observers make records every minute of each chimney and stack in sight.

"The gradual lessening of the smoke nuisance is due, in a large measure, to the perfecting of smokeless boilers," says a leading consulting engineer. "The municipality has found that it should practice what it preaches, and now the stacks on the majority of our public buildings are not smoking as formerly."

Lewis & Kitchen, contractors, Chicago, state: "We use the firebox boiler very extensively in our school house work, from 30 inches in diameter and 6 feet in length up to those 72 inches in diameter and 18 feet in length, for pressures running from 5 pounds to 80 pounds.

"In our two offices at Kansas City and Chicago we average the installation of heating apparatus in about 100 schools per year, and we feel that our experience is rather wide.

"We use the smokeless firebox boiler very extensively in our work. The top grates are water grates, upon which the main body of fuel is consumed; the fire on the lower grate is that which falls thru from the grates above. The draft is taken thru the door above the top body of coal, drawn down thru the burning bed of coal and passes over the hot coals on the lower grates. By this process the carbon is burned from the gases before it has a chance to be condensed into smoke.

"Many engineers do not realize that in order to secure the best results the smoke connection and chimney should have an area 15 to 25 per cent greater than the combined area of all tubes in the boiler. This is to allow for friction and expansion of the gases, which increase in volume as they are heated in the firebox. The fact of a strong draft that would draw a newspaper up the chimney is not evidence of the right kind of draft to generate steam and properly consume the coal. It requires 300 cubic feet of air for the proper combustion of one pound of ordinary coal. This air must pass thru the firebox slow enough to permit mixing with the furnace gases for proper combustion."

Mayor Harrison for Greater Chicago

At a recent dinner in his honor, Mayor Carter H. Harrison of Chicago, called special attention to the fact that the corporation counsel of the city has been in that office for ten years; the commissioner of public works has served in various bureaus of the public works department for many years, passing thru the offices of superintendent of streets and city controller to his present position, and the health commissioner has been drafted from the marine hospital service, where he had special training for his work.

He himself has been in the mayor's chair for ten years and has not missed a meeting of the city council.

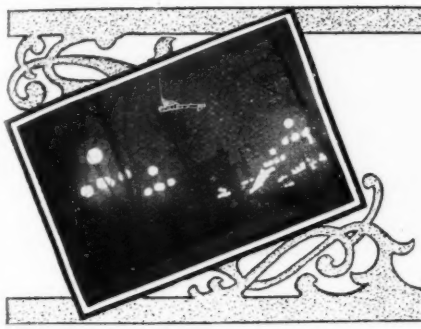
These facts show the tendency of the city administration outside the lines of the civil service toward retaining efficient men in office and promoting them without reference to partisanship.

Mayor Harrison recounted the progress made toward the great lake front project thru contract with the Illinois Central Railroad; the lack of progress on the outer harbor, because of the defective titles and insufficiency of the laws enabling the city

Carter H. Harrison, Mayor of Chicago.

to condemn the property; the stoppage of the Twelfth street widening by a Supreme Court decision; the general progress of the internal transportation plans, under which the city will ultimately own all the lines in the city; the general lack of money for the projects for city improvement.

He spoke enthusiastically of the beauty of the projected Greater Chicago and asked the aid of those present in securing from the legislature the right to raise more money, and from the city council the greater appropriations necessary. His energy and efficiency go far toward attaining the desired ends.



STREET LIGHTING

Street Lighting

By K. G. Rennie, Consulting Illuminating Engineer of St. Joseph, Mo.

The purpose of street lighting has remained the same, and it is now, as it was four centuries since, a measure of public safety and an adjunct to the police force. The police should be able to note the actions of suspicious characters before they stumble over them, or to detect the number of a law-breaking automobile before it has vanished into the distance. All the requirements of a complicated civilization demand lighting upon a vastly more liberal scale than sufficed for earlier days, or than is found in many localities even now. It is pertinent then to inquire into the conditions of visibility that are present with artificial light in the street, and to find their bearing upon the intensity of light required.

Except in the vision of details at comparatively short range we see things by virtue of their difference of color and luminosity. In weak light, color as such is inconspicuous, so that practical vision depends chiefly upon the power of distinguishing differences of luminosity. So far as the problems of artificial illuminations are concerned, objects do not range over a wide scale of luminosity.

Whatever may be the absolute values of light received the relative values as expressed by the coefficient of reflection range practically from about 0.1 to 0.04, or a little less. In other words, the blackest object returns about one twentieth the light returned by the brightest object. Ability to distinguish between stationary objects by their differences in luminosity depends then on the capacity of the eye as regards shade perception.

The fundamental fact underlying this is that the eye can perceive within a wide range of absolute intensity a fairly constant difference in luminosity.

As the illumination falls below about 10 lux we see less well, so that by the time the illumination is down to 1 lux our shade perception is very seriously impaired, as is also our ability to distinguish details, visual acuity, etc. It should be mentioned in this connection that the loss of shade perception at low illumination is very powerfully influenced by state of adaption of the eye with respect to light or darkness. With the eye well adapted to the dark fair shade perception can be carried into illuminations very much lower than ordinary. It is chiefly this fact which from the standpoint of street illumination, renders glaring lights so troublesome.

In twilight vision one sees things not as distinctly perceptible, but as dim forms and shades of uncertain boundaries and character. Only when the objects subtend a fairly large visual angle does one see them in the least clearly. This is the familiar vision of a bright starlight night, or a dimly illuminated street. In its beginning one cannot even distinguish large stationary obpects from their background. The first perception is that of objects in motion, which seem to catch the eye more readily than when they are at rest.

Street Light Must Be Stronger Than Twilight

No illumination which depends chiefly on twilight vision can be seriously considered for the purposes of street lighting. It, of course, has its usual place in merely enabling one to find the way. The common citizen wants to distinguish the shadow of a post from a hole in the pavement before he is fairly upon it. The man who is driving upon the streets needs to see his way clearly, without risk of running into the gutter, and the policeman should be able to tell a belated householder from a burglar using his jimmy on a window or a front door. And finally in many places it is highly important to have enough additional light to distinguish faces clearly, to see even trivial obstacles easily and to read the numbers on houses, or if need be, to consult an address book or a time table.

I shall here classify the streets, or consider them divided for the purpose of street lighting into first, second and third class.

Streets Requiring First-Class Light

By first class I mean the principal streets of a city from the standpoint of amount of nocturnal traffic and the requirements of the police. A chief street may be the principal business street of a city that is humming with activity after nightfall. It may be the leading street to a crowded railway station, where carriages and foot passengers are constantly circulating until late in the evening, or it may be a comparatively humble business street in a portion of the city where the police have found from experience that only constant watchfulness can keep down crime.

The streets which require first-class illumination are by no means only the streets of stately business blocks or magnificent residences. The ordinary streets of a city or town fall into another category. Traffic after nightfall is light, or only moderate.

Streets Requiring Second-Class Light

The streets are reasonably orderly and the general conditions are such that neither from the viewpoint of the wayfarer nor from that of the policeman is brilliant illumination necessary. They are the ordinary quiet residence streets of the average city and the business streets on which there is little traffic by night. These streets would naturally figure up about three-fourths of the total mileage in the average city. These may be regarded as second-class streets from the illuminating standpoint, requiring good lighting, but not of the highest pitch of brilliancy.

Streets Requiring Third-Class Light

Finally there are in every city a number of streets which require practically very little illumination. They are mostly in the outlying portions of the city, and sometimes they are mere roads leading away from the structural part of a city. For such it is necessary to provide only such illumination as will serve to mark the way and to render progress through them easy, considering the conditions of traffic. Occasional outlying streets, not at all important as residence streets, are still considerable traffic carriers, being thru roads from one part of the city to another, or from the city to some particular suburb or neighboring town. In these days of the very great use of motor cars almost everyone will recognize in his own town streets to which this condition applies. Such from the standpoint of the illuminating engineer are classed as second-class streets rather than third-class streets. They demand the illumination required by considerable traffic.

As to the intensity of lighting required for streets of these several classes the requirements have by popular consent been slowly and steadily rising. On the physiological basis, which enables one at least to determine what lighting is necessary for reasonably good vision for various purposes, one can form a fair approximation of conditions to be met.

First-Class Lighting Defined

First-class streets in constant use for dense traffic of one kind or another, or so classified from the police standpoint, certainly require reading illumination, and this is the kind of illumination the first-class streets get in most European and some American cities. The intensity of the illumination required is practically that specified for public places, that is, an extreme minimum of 0.5 lux, an average of fully double that amount. Theory and practice concur in holding that a street so lighted is well lighted. In each case it should be understood that the minimum cannot be permitted to apply to any material portion of the street area. An intensity here specified mainly on theoretical grounds is substantially that deemed advisable by several foreign investigators and carried into ractice with entirely satisfactory results.

Second-Class Lighting

As regards second-class streets the requirements are, of course, less severe. There should be, as a matter of convenience, light enough to recognize a friend without stumbling over him, to read an address, or to see the number of a house comfortably. The average illumination for this purpose may be set at not less than 0.5 lux, and the minimum should be nowhere less than about 0.25. Streets so lighted will be comfortably lighted near the lamps, and the lighting will be as good or better than moonlight, even at the darkest spot.

Third-Class Lighting

Finally we come to the third-class streets. The degree of illumination required need not be greater than is afforded by bright moonlight, and should be as great as one finds in dim moonlight. It is illumination similar to that which is required for some of the park lighting, say from 0.3 down to 0.1 lux or thereabouts. At such low intensities it would be better to cut down the intrinsic brilliancy of the lights by screening, as in park lighting, so as not to spoil the dark adaption which is necessary for utilizing so low a degree of light. In streets so dimly lighted the silhouette effect is rather marked, and it is not desirable to forego the advantage of a tolerably light surface on the streets. The coefficient of reflection of roadways varies greatly according to their surface and the angle of incidence. (Direction of rays). At fairly large angles of incidence a dirt road, or a high dusty bit of ordinary macadam

may give coefficients as high as 0.25 to 0.35; under similar conditions a dark pavement or a bit of oiled macadam may give coefficients from half of these figures down to as low as 0.05, which low values greatly increase the difficulty of proper illumination. Considerations of economy in street lighting enforce such classification of streets as here described.

Moonlight Schedule Insufficient

Few cities can afford even at the present scale of public expenditures to light brilliantly any large proportion of their streets. If an attempt were made to light all the streets alike there would be no first-class lighting at all. In small cities, where the traffic is never very dense, and the use of streets at night moderate, very little first-class lighting is required, and the amount necessary will diminish with the traffic. The burden of lighting perhaps falls more heavily on small cities than on large, owing to the large amount of street mileage compared with the assessable values. Hence, in such places there will be, and properly may be from the conditions, a relatively considerable amount of third-class lighting, but even so the cost of lighting is sometimes a serious matter. To keep down expense and yet to adjust the lighting conditions as well as may be, various attempts have been made to reduce the hours of lighting per year, while yet meeting fairly the practical requirements.

The earliest attempt of this kind was based on cutting out all the lights on moonlight nights. Such schedules are unsatisfactory for the weather is no respecter of moonlight, and the nights near the full moon are, in point of fact, sometimes as dark as the darkest.

The only suitable lighting for cities of any importance is the all night and every night schedule. This is commonly based on starting the lamps half an hour after sunset and extinguishing them half an hour before sunrise every day in the year. The all night and every night schedule, will be found to run between 3,900 and 4,000 hours a year. If the full schedule is to be modified it is better to modify it in the morning hours than in the hour of lighting up, by reason of the greater traffic in the evening. The so-called moonlight schedules vary according to assumptions regarding effectiveness of moonlight, but run a little over 2,000 hours per year. A modified moonlight schedule starts with lighting from dusk to midnight every night, and takes on the moonlight schedule by extinguishing approximately an hour after moonrise after midnight. Such schedules run to about 3,000 hours per year. The reduction in cost is not, of course, proportionate to the reduction in hours, so that the economy is to a certain extent rather apparent than real.

Extinguishing Part of Lamps Better Plan

A better plan is followed in some European cities of lighting all the lights every night from dusk to midnight, or 1 o'clock, and then extinguishing part of them. This plan is coming into rapid favor in nearly all of the principal cities in America and Europe where ornamental posts are used with cluster lights, and is acknowledged to be the most economical illuminating system yet introduced. On the whole this plan is sure to give better illumination than any form of moonlight schedule which might be arranged.

The only question which is properly raised is whether it may not be feasible, say after midnight, on account of the changed conditions in the streets, and hence to reduce the illumination in them by cutting out, say every other light or cluster.

The same reasoning might apply to a few second-class streets. A consistent application of this principle might reduce the average hours of lighting per year from 4,000 of the all-night schedule to some point between 3,000 and 3,500 hours, depending on the number of lights affected. If rigorous economy in street lighting is absolutely necessary this line is the logical one to follow.

Direction of Street Illumination

The plane of illumination, that at which the required intensity should be found, is commonly taken at 1 to 1.5 meters (3.3 to 5 feet) above the pavement, merely as a matter of convenience.

The vertical component of illumination has practically seldom to be considered in street lighting, save in its effect on nearby buildings.

A uniform spherical distribution is bad for the purpose of street lighting and the practical question regarding an illuminant for such use is how much of its effective flux of light can be conveniently turned downward upon the street. Light above the horizontal is not wasted. It does great service by illuminating buildings. A radiant for street lighting should, however, be judged substantially by the lower hemispherical intensity, taking the lamp and its reflecting system together. Reflectors of diffusing balls, or glass, are useful with all varieties of street lamps merely for the purpose of diffusing the light and to send it in useful directions.

In thickly built up important streets the enormous light flux from powerful light sources is so useful for the general purposes of illumination that it pays to employ them. Particularly this is the case since it is true both in gas and electric lighting that the very large units are of much higher efficiency than the small

ones. On the other hand, in streets requiring only moderate illumination and particularly streets hung low with shadowing trees, the small light, which for efficient use must be hung rather low, is greatly to be preferred. In streets of the third class, where every effort is being made to make little illumination go a long way in point of usefulness, and where the conditions are such that there are no lateral reflecting surfaces to be utilized, the small unit is imperative.

Height of Street Lights

As a rule, all illuminants in American practice are mounted lower than they ought to be for efficiency, that is, lower than the point at which the form of distribution curve is utilized to the best advantage. Powerful arcs or equivalent gas lamps should be mounted at least 8 or 10 meters (26 to 33 feet) above the pavement, and with the very large units even considerably more, up to 15 or 20 meters (44 to 66 feet). Lamps of the type of the larger incandescent electric units and the corresponding gas lights need to be carried to the vicinity of 5 meters (17 feet) high (or thereabouts) for economical results, varying somewhat with the type of reflectors employed. Practically, at the present time one has to choose between radiants giving, say 50 to 200 c. p. on one hand and 500 to 2,000 on the other, only a few commercial sources running to still larger powers. In designing street illumination one virtually has to elect between using sources of the one or the other of these types.

In placing lamps, large or small, it is imperative that they should be located so that their useful light flux can be utilized. This condition is often violated by placing lamps where their light is very largely cut off by trees. By far the best method of placing street lighting poles is along the edge of the walk, close to the curb, having the units parallel up and down the section of streets to be illuminated.

Ornamental Poles

You have often heard the following theories advanced on ornamental lighting:

First, commercial development of the city for trade follows the light.

Second, illumination value, safety and comfort for vehicles and pedestrians.

Third, civic beauty, enjoyment of the city by its citizens.

Good street lighting provides an abundance of agreeable light where it is needed, and the equipment with which it does this must add decorative effect to the appearance of a street.

It also makes money for a city, by adding to its attractiveness, increases its trade, and advertises it to the people of other places without special additional expense.

On the other hand a poor system of lighting is wasteful, as well as hideous. Nearly all of its cost is a loss. People live and do business on a street thus deprived of proper light, not of their own choice, but because they have to.

Wherever there are intensely bright light sources without having proper glass or globes, the effect in dazzling. The pupil of the eye unconsciously contracts to protect the eye against the injurious effect of this piercing light, and this makes seeing almost as difficult as does the lack of light, and much more painful. Anyone who looks at the usual form of arc light knows the momentary partial blindness and discomfort that follows.

Good illumination gives an even illumination all over the street, on footway and roadway, without any shadows. Concentrated efforts should be made to eliminate glare in one spot and darkness or shadows in another.

When first introduced the ornamental system was looked upon as an expensive luxury and would probably be used only for small installations, put in privately by individuals, or for the exterior lighting of public buildings. The use of heavy cast iron posts and expensive underground conduit construction made the system almost prohibitive. However, the introduction of standards of lighter designs and the perfection of a well-insulated lead covered steel taped cable for underground use without conduit has brought the cost of ornamental lighting within the reach of any community.

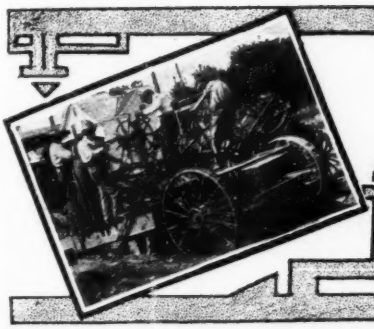
One must not overlook the fact that ornamental poles may be used in connection with gas street lighting system as well as electric. But at the present time electric lighting with ornamental poles seems to be a great deal more popular than gas. Classic ornamental street lighting poles ornament the streets in the day time as well as at night, and the general appearance of the street is very materially affected by the appearance of a handsome iron standard of classic design. These poles may be in one, two or three, four or five lights, and even more if desired, but as a rule one, three or five light standards are usually chosen.

It might be well to note that at some former time a city had installed a section of street lighting system, and at a later date would see fit to increase the illumination. This can be accomplished in three different ways:

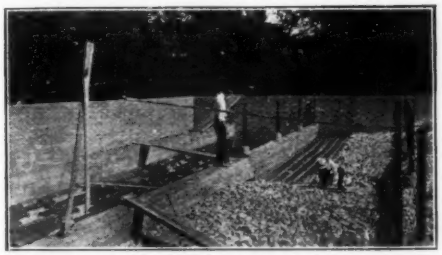
First, to install more poles in the section desiring increased illumination.

Second, to increase the size of the iluminants.

Third, to increase the number of arms to the post, which should be so constructed as to permit of a change of this kind, without materially affecting the cost.



PROMINENT CONTRACTORS



FILTER BED, *showing stone and riser pipes to be fitted with Taylor Nozzles.*

VIEWS *of drains and crushed stone.*

Henry J. McNichols Company, Chicago

The Henry J. McNichols Company was founded in 1883, by Henry J. McNichols, president and treasurer; Arthur McNichols, vice president, and R. J. McNichols, secretary, with offices in the Rookery building, Chicago.

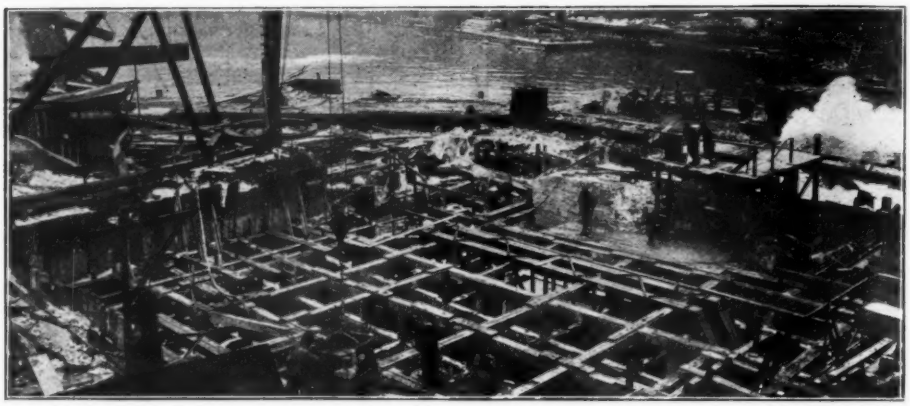
The company since its organization has made a specialty of sewer construction and has constructed many of the large sewers now in use in Chicago and surrounding country. During the year 1912 this company completed among other large contracts, 10,000 lineal feet of concrete and tile pipe sewers in Lyons, Ill., thru solid rock, at a cost of $225,000, and the outlet sewer and sewerage works for the village of LaGrange, Ill. This consisted of 170 lineal feet of tile pipe, 850 lineal feet of 8-inch tile pipe enclosed in concrete, 2,010 lineal feet of 15-inch tile pipe enclosed in concrete, 6,500 lineal feet 16-inch tile pipe, 65,000 lineal feet concrete sewer 6½ feet internal diameter, 150 lineal feet 14-inch cast iron pipe, enclosing the outfall of settling tank at side sewage pumping stations, machinery, of work, concrete manholes, catchbasins, settling tank, dosing chamber, etc.

The pumping station of the LaGrange plant is constructed of concrete and equipped with a vertical centrifugal

BUCYRUS *Steam Shovel in operation. H. J. McNichols Company, Chicago, Contractors.*

CONCRETE *and tile pipe construction through rock. H. J. McNichols Company, Chicago, Contractors.*

pump, with a submerged suction, 6 inches in diameter and cast iron casing; power furnished by a 60-cycle, 220-volt motor of 5-horse-power capacity. The dosing chamber consists of two compartments, provided with inlet valve sand siphons siphons with two filter beds made up of two concrete basins, fitted with cast iron gate main supply pipe, which connects with lateral supply lines, 5 inches in diameter, extending across the floors of filter beds, and encased in concrete. In each filter bed, 49 riser pipes, each fitted with Taylor nozzles, connect with the lateral supply pipe. Upon the floor of filter beds and around the under drains is placed a 12-inch layer of clean limestone, passing thru a 6-inch ring and retained on a 2-inch ring. Upon this is placed a layer of filter material, consisting of broken limestone, passing thru a 2-inch ring and retained on a 1¼-inch ring. The work was completed at a cost of $110,000. The plant was designed by the late W. W. Ewing, with Langdon Pearse as consulting engineer. The Central Engineering Bureau, Monadnock building, Chicago, supervised the construction. The equipment of the company consists of two Bucyrus steam shovels, one Parsons trenching machine, with Decatur backfiller attached; one back filler, equipped with a Monahan engine; three concrete mixers, one Chicago system of well points for work in wet sand and various kinds of pumps.



WASHINGTON STREET BRIDGE, *showing construction of west abutment. Fitzsimmons & Connell Dredge and Dock Co., Chicago, Contractors.*

Fitzsimmons & Connell Dredge & Dock Co.

Fitzsimmons & Connell Dredge & Dock Co., Chicago, Ill., founded in 1870 by General Fitzsimmons and C. J. Connell; incorporated in 1878 as the Fitzsimmons & Connell Company, and in 1911 incorporated again as the Fitzsimmons & Connell Dredge & Dock Company, 1641 Otis building, with the following officers: C. J. Connell, president; H. N. Cooper, vice president and treasurer, and J. T. Lillis, secretary.

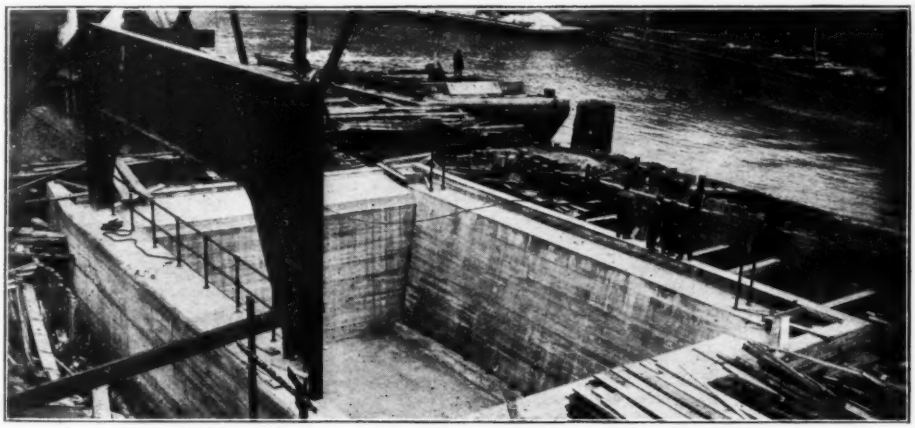
The company, since its organization, has made a specialty of river, lake and bridge substructure work and has had extensive contracts for the construction of intake cribs, water tunnels, dredging, docks, breakwaters, pile and concrete foundations, breakwater and harbor improvements. Among the larger contracts carried out by this company is the construction of the Carter Harrison crib and 10-ft. brick lined tunnel with a 13-ft. bore under Lake Michigan, connecting the crib with the land tunnel, a distance of approximately five miles, three miles of which was under the lake; the construction of a breakwater and crib protection around the Chicago avenue intake crib, and the Chicago river and the Harrison street power plant of the Commonwealth Edison Co., the construction of approximately 5,000 lineal feet of breakwater along the water front for the South Park Commissioners; the construction of the center piers of all old style swing bridges now in existence between Rush street and 12th street, over the Chicago river; the construction of the substructures of the Scherzer rolling lift bridges at Van Buren street, Taylor street and the Metropolitan elevated railway.

During the year 1912, the company was awarded the contracts for constructing and erecting a 100-ft. steel truss bridge on steel pontoons over the Chicago river at Belmont avenue, the substructure of the double leaf bascule bridge over the Chicago river at Indiana street, and the substructure of the double leaf bascule

bridge over the Chicago river at Washington street.

In the construction of the Washington street bridge, which measures 179 feet 4 inches between centers of trunnions, and lies directly above a double track street car tunnel, many complex situations arose. As this tunnel was directly beneath and parallel to the line of the bridge, it was found necessary to sink concrete cylinders on either side of the tunnel and upon this were placed concrete piers reinforced by steel trusses, the whole forming a concrete box, which straddled the tunnel without placing any load upon the roof. In the construction of the temporary cofferdams, it was found necessary to use steel sheeting of a length sufficient to withstand the pressure of the water and yet not penetrate a tunnel used by a public utility company for carrying its wires beneath the river. This required considerable back filling of clay. To support the roof of the street car tunnel, which carried this load, heavy timber bents were placed along the center line of the tunnel on jack screws and left there until cofferdam was removed. Another interesting feature of this work was the removal of the roof of the original tunnel, built in 1865, and since lowered on two different occasions.

The equipment of the company consists of two river tugs, three dipper dredges, five pile drivers, equipped with Lidgerwood and Mundy hoists and Smith, Marsh, Capron and Channon concrete mixers, and Morris centrifugal, Blake and Knowles pumps and Insley buckets.



WASHINGTON STREET BRIDGE, *showing west abutment completed.*

Personal Notes

R. Winthrop Pratt, of Cleveland, O., has been retained to assist Charles S. Latshaw, city engineer of Fostoria, O., to prepare plans for enlarging and remodeling the purification works. He has been retained by the director of public service of Canton, O., to make a report and general plans for sewage purification plant for that city, and also to make a report upon means for protecting New Castle, Pa., from damage by floods, of which city C. H. Milholland is the city engineer.

George Y. Craig, formerly city engineer for Omaha, Neb., has been appointed city engineer of Calgary, Alta., and A. Fox. of Minneapolis, has been appointed waterworks engineer.

J. C. Travilla, street commissioner of St. Louis, Mo., has announced his intention of resigning within a short time. He will take charge of the $1,000,000 road project of Tarrant county, Texas. It is estimated that the work will require two years to complete and during that time Mr. Travilla will have headquarters in Fort Worth, but will continue to make his home in St. Louis.

J. R. Wemlinger, president, Wemlinger Steel Piling Company, has been re-elected for the second time secretary of the American Society of Engineering Contractors, with headquarters at 11 Broadway, New York, and branches in Chicago, St. Louis, Indianapolis, and Regina, Canada.

Walter H. Flood, recently in the government service, has been appointed chemical engineer in charge of the paving materials laboratory at the municipal asphalt plant, bureau of streets, Chicago, Ill.

Edward H. Kingsbury has been appointed commissioner of public works of Little Falls, N. Y.

Lewis E. Smith has been appointed city engineer of Pasadena, Cal.

PERSONAL

Chicago Voting Machine Contract

The Chicago Bureau of Public Efficiency recently made an investigation of what they term "the ill-advised and extravagant contract made by the Board of Election Commissioners in July, 1911, for the purchase of 1,000 voting machines, the contract price of which amounts in the aggregate to $942,500."

The first 200 machines on this order were delivered and paid for under an appropriation made in 1912. The election commissioners are asking for an appropriation to pay for 300 in 1913. This leaves 500 not yet provided for in their applications for appropriations.

The total cost of the 800 machines would be $754,000. The report of the bureau asserts that the Supreme Court of Illinois has decided that these machines do not comply with the requirements of the voting machine statute.

The Bureau of Public Efficiency made an investigation of this matter in 1911 before the contract was awarded and then recommended that not more than 100 machines be purchased until they had been thoroly tested in the primaries and election of April and November, 1912; and that the Board of Election Commissioners consult the financial authorities of the city, which must pay the bills, before taking action. To quote from the bureau's latest report: "In face of the situation above set forth, of which they were fully advised, and notwithstanding the adverse comments of the public press, the Board of Election Commissioners and the Empire Voting Machine Company disregarded every principle of business prudence and in July, 1911, entered into the contract mentioned for the purchase of 1,000 machines."

When the 1912 appropriation to pay for 200 machines was pending the bureau asked that the contract be modified to order not more than 100 machines on the first installment and make the order for the rest contingent on the success of these. But, on advice of the corporation counsel that the obligations of the Board of Election Commissioners must be paid by the council, the appropriation was made apparently without sufficient inquiry as to whether an obligation had been incurred.

The question whether the voting machines purchased by the money appropriated comply with the law was taken to the Supreme Court, which has decided that "as a matter of fact, we find that the machine does not comply with the law in enabling the voter understandingly to cast his vote in one minute."

Since the "voting machine statute is explicit on the point that no voting machine shall be purchased unless it is so constructed as to meet all the requirements specified in that act" the Chicago Bureau of Public Efficiency is of opinion that "there is no legal liability on the part of the city to pay for the voting machines in question" and that any appropriation by the council would be illegal and expose its members to severe criticism. It submits "that the claim of the Empire Voting Machine Company shall not be recognized by a contingent appropriation or in any other form" and asks that the corporation counsel be directed "to contest vigorously any suit or proceeding which may be brought to enforce payment for any of said machines."

St. Paul's New Civic Organ

It is a pleasure to welcome into the field of current literature created by the necessities of commercial and civic organization, a new publication, *St. Paul Ascendant*, published by the St. Paul Association of Commerce. The first issue bears a December date and it will for a time at least appear once a month. The St. Paul business world has reached that stage in organization and co-operative spirit when it requires an organ, and this one is full of promise.

Technical Associations

The Colorado Association of Members of the Am. Soc. C. E., listens to an illus-

trated lecture on the Reclamation Service work by Raymond F. Walter, on March 8.

More than fifty papers are on the program for the fifth annual meeting of the Illinois Water Supply Association, held at the University of Illinois, March 11 and 12.

The Minnesota Surveyors and Engineers Society held a very successful convention at St. Paul, February 11-13, with over one hundred present and a program of twenty-five papers and reports. More than two hundred attended the banquet and added impetus to the cause of good roads.

On March 12, Myron L. Fuller presents to the New England Water Works Association a paper on "Quantitative Estimation of Ground Water for Public Supplies," and the committee on water consumption and statistics relating thereto makes a report.

The Federal Aid Good Roads Convention of the American Automobile Association was held at the Hotel Raleigh, Washington, D. C., March 6 and 7.

The meeting of the National Paving Brick Manufacturers' Association at Chicago, March 3, 4 and 5, was of unusual interest. It was addressed by several men not members of the association, such as S. T. Henry, on "The Relation of the Trade Journal to Municipal Work"; H. M. Waite, chief engineer of Cincinnati, on "The Engineer's View"; E. B. Schmidt, assistant city engineer of Louisville, on "The Manufacturer, His Hindrance and His Aid," in addition to several papers by members, all tending to bring about more co-operation between engineers and brick manufacturers. The convention was held during the two weeks of the Clay Products Show, which is annually developing as an exposition of this vast field of manufacturing industry. One novelty of the show was a brick house sent by parcel post, having been built of bricks sent by makers all over the country by means of the new method of transmission.

Prof. Arthur H. Blanchard presented an illustrated paper on "The Highways of Europe" at the February 26 meeting of the Municipal Engineers of the City of New York.

The Indiana Sanitary and Water Supply Association held a successful convention in Indianapolis, February 25 and 26, with a very full program covering nearly all phases of the water supply problems.

The newly organized Chamber of Commerce of the United States of America issues a monthly publication entitled *The Nation's Business*, the latest number of which gives a report of the first annual convention of this body.

The central idea of the Panama-California International Exposition to be held in San Diego, Cal., every day of 1915, is to make the most comprehensive display ever assembled of processes, including those of manufacture. No space will be given to the display of products.

The Brooklyn Engineers' Club, 117 Remsen street, Brooklyn, N. Y., has appointed a committee of award of the Alfred T. White competition prizes for plan of reclaiming city land at Coney Island, first prize $150, second prize $50. The committee has issued specifications to be followed by the competitors, which will be sent on request, with a plat of the ground to be studied. The plans must be in the hands of the committee by May 15, 1913, and the award will be made a month later. Edward M. Bassett is the chairman of the committee of award.

Personal Notes

G. G. Hall has been appointed city engineer of South Bend, Wash.

Stanley R. Tighe has been appointed city engineer of Cohoes, N. Y.

Will Gooden has been elected highway commissioner of Franklin, N. H.

John K. Sague has been appointed commissioner of public works and E. W. Sylvester superintendent of public works of Poughkeepsie, N. Y.

G. P. Wing has been appointed city engineer of Nashua, N. H.

J. H. Putnam has been elected city engineer of Hattiesburg, Miss.

Elmer Lenfest has been made city engineer and A. W. Campbell street commissioner and water superintendent of Snohomish, Wash.

William H. Lawton and J. K. Sullivan have been reappointed city engineer and street commissioner, respectively, of Newport, R. I.

M. L. Culley has been appointed city engineer of Jackson, Miss., and J. W. Cullen has been made street commissioner.

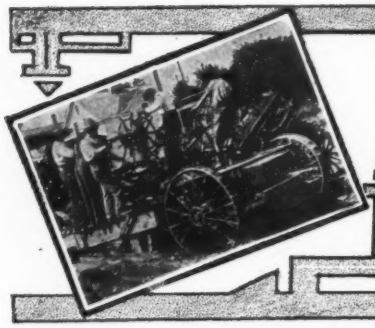
F. W. Cappelen has been appointed city engineer of Minneapolis, Minn.

Adolph Jadel has been appointed a member of the board of public works of San Francisco, Cal.

John E. Fearing has been appointed city engineer of South St. Paul Minn.

Frank W. Cherrington, formerly of Cincinnati, is now chief engineer for the Jennison-Wright Company, Toledo, O., manufacturers of creosoted ties and structural timbers.

Julian Kendrick has resigned as chief engineer of the Rudolph S. Blome Company, of Chicago, and has opened an office as consulting municipal and hydraulic engineer in the First National Bank building, Birmingham, Ala.



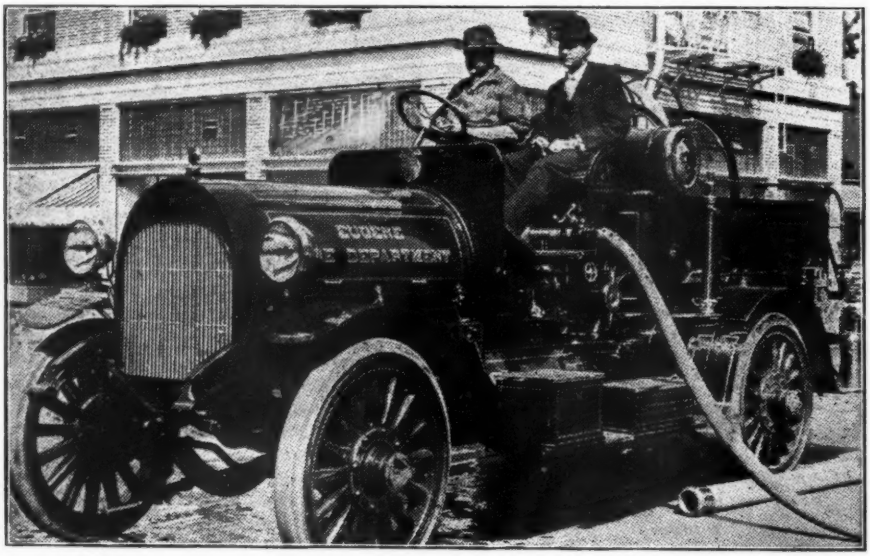
MACHINERY AND SUPPLIES

Oakland is Motorizing

By N. A. Ball, Chief Engineer, Fire Department, City of Oakland, Cal.

Altho this department has not been using motor pumping engines for any considerable length of time, our experience to date has been exceedingly gratifying, and our department will be speedily motorized throughout.

Our latest self-propelled addition is a 53-h.p. combination motor pumping engine, with chemical equipment and hose carriers. This machine has the original long stroke motor cylinders, being 5¾ by 8 inches. The intake and exhaust valves are exceptionally large, 3⅝ inches in diameter. The water space around the cylinders for cooling is more than double the space used on the average gasoline engine. The thickness of the walls, outer and inner, is more than double the thickness as commonly used in gasoline engine construction. This same comparison is noticed all thru the construction. Take, for instance, the connecting rod. It is four times the strength of that used on the ordinary gasoline engine, even of the same bore cylinders. The wristpin bearings are exceptionally heavy and large in diameter. The crankshaft, the most important part of the machine for a heavy load, is cut out of a good, solid billet of steel, not a welding, upset or squeeze in the entire operation. This is the expensive way to make a crankshaft, but it is far the best way. The crankshaft is 3 inches in diameter. The crankshaft bed is made of semi-steel, not plain cast iron. The frames are very long and heavy and are exceptionally well braced. The main frame is trussed with heavy steel rods. The transmissions are made from the very best grade of chrome-nickel steel, and every gear is cut



OAKLAND, CAL., *has added a motor fire engine like this to its department.*

from a solid block of steel. There is not a particle of forging in the entire transmission. The teeth are very heavy and wide across the face.

The same double construction also applies to the axles. The front axle is 2¾ inches at the collar, while the rear axles are 3⅛ inches at the collar, and it is very unlikely that they will ever sag or spring, tho subjected to the hardest kind of usage. I understand that these axles, and they particularly appeal to a fire engineer, were designed by the designing engineer of the Nott Fire Engine Co., and made by the Sheldon Axle Co., Wilkes-Barre, Pa.

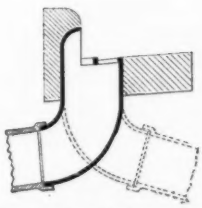
This engine has a rated capacity of 500 gallons, and easily delivers 542 gallons thru two lines of 2¾-inch hose and two 2⅛-inch nozzles, at 113 pounds net pressure on the pump, with a lift of 12 feet and 4 inches.

Seven men are required, in a residence district, to operate this engine, after same is set and working at a fire. One man can operate the pump itself. The salaries are as follows: Captain, $135; driver, $102; five hosemen, $102 per month each. This is for first year of service. Add $10 each with the exception of captain for second year and $5 each for third year and succeeding years. Duties of captain are those of regular captain of company. The driver is the only man required for operation of motor. Other men have been trained to operate machine in absence of the regular driver.

The Oakland fire department is growing rapidly. The department, at present, consists of sixteen engine companies, including engines and wagons, high-pressure pumping station, five truck companies, one chemical and three combination hose and chemical companies. The department numbers 262 officers and men. Three new fire houses are now being completed, which will give twenty-two houses in all. We already maintain seven pieces of motor-driven apparatus and seventy-six horses. The companies carry 38,700 feet of hose. There are 228 fire boxes in the police, fire and telegraph system. The cost of maintenance of the department for the year 1911-1912 was $364,708.19.

The Municipal Gutter Inlet

The Municipal inlet was designed to meet the conditions where the existing catchbasins are in a position other than on the line of the curb of a proposed street improvement. The catchbasins are located and built at fixed distances from the center lines of the streets where the sewer system is installed, and consequently will be in the line of the curb for one width of the roadway only. This means that it will be found generally necessary to convey the street drainage from the gutter to the existing catchbasins by means of an inlet and sewer pipe connection. The old method of providing for an opening through the curb and connecting to the catchbasin brought the pipe connection within a few inches of the surface of the parkway, which will readily be noted as poor construction.

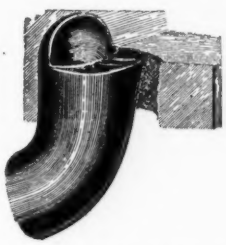


CROSS SECTION *showing connection to catchbasin in parkway, dotted lines showing connection to catchbasin if in roadway.*

The Municipal inlet is a one-piece iron casting, set in the curb and gutter, and because of its goose-neck design, makes its junction with the sewer pipe connection to the catchbasin well below the parkway.

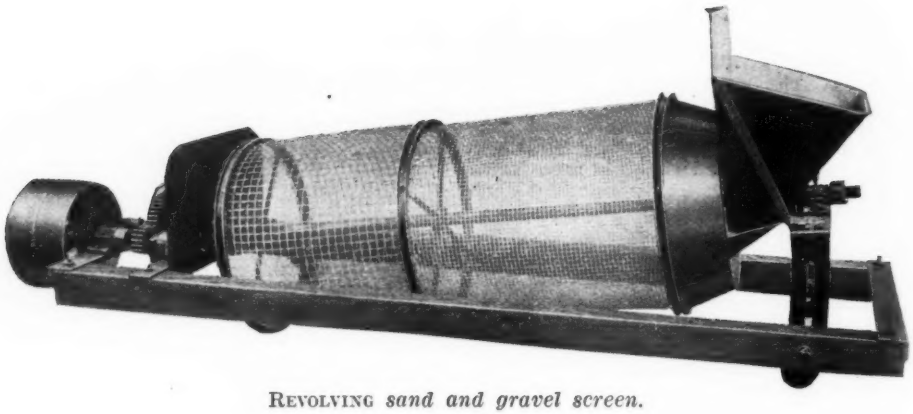
This inlet is made of one solid casting and has no grates to become loose and carried away. Because of the "hooded" height above the surface of the gutter, it is almost impossible for the inlet to become clogged, and it is easily rodded and flushed.

When the street improvement provides for curb and gutter, the inlet is set in accurate position and the concrete is merely tamped around it, allowing of the uninterrupted construction of the curb and gutter. This feature will appeal to both engineer and contractor. The appearance of the street being important, it will be noted that this inlet when in place presents a pleasing and inconspicuous effect.



Sectional view showing a No. 3 Municipal inlet in position.

These inlets can be made in different sizes to meet requirements, and are made by the Municipal Inlet Company, of Chicago, who will be pleased to furnish any further details.



REVOLVING *sand and gravel screen.*

Revolving Sand Screen

The sand and gravel screen, shown on this page and manufactured by the Cement Tiling Machinery Co., Waterloo, Ia., is exceedingly simple in construction. It is being extensively used in the municipal contracting field as it obviates the necessity of divers cumbersome and expensive machinery, thus placing the screening and grading of sand and gravel among the more simple problems which the contractor must contend with.

The machine illustrated has a capacity of 500 cubic yards per day and has an 8-foot bed, 4-foot 6-inch by 2-foot drum, covered with galvanized wire cloth mesh to suit requirements.

Economical Squeegee Cleaning

By Wm. A. Larkins, Commissioner of Street Cleaning, Baltimore, Md.

The abnormal growth of Baltimore has placed her in the front rank of the country's principal cities, and in her methods of street cleaning and economies she is keeping pace with her sister municipalities. Therefore the blocking system among the hand-broom sweepers in lieu of gang or section service has been introduced upon our improved streets and in the commercial part of the city. By the traffic block system, where the hand carts have been used with most satisfactory results, we are encouraging the extension of the blocking method to all of Baltimore's improved streets, as soon as the same are completed by the paving commission. This system with the washing machines as an adjunct places our city in the front ranks of the cleanest cities.

There is no doubt but the public health is seriously affected by dust rising from streets. It has been proven by Metchnikoff, of Paris, that much of the infant mortality in summer in the cities is due to microbes found in the manure of horses. In dry weather these microbes are spread by the winds, entering houses and proving fatal to young children.

For above reasons we avoid all possible raising of street dust and in attainment of above aim make a very extensive use of squeegee machines. We have regular routes mapped out for the machines on regular days, and we find that they easily clean 45,000 to 50,000 square yards of pavements in a day of eight hours. We send the squeegees over bitulithic, sheet asphalt, asphalt block and vitrified brick pavement with equally good success.

This machine, which is a German invention and is manufactured by the Kindling Machinery Co., Milwaukee, Wis., sprinkles the water in the street like an ordinary cart and immediately scrubs the pavement with a large rubber squeegee. It is extremely economical in operation and in fact it does the work of sprinkling wagon, street sweeper and hand scraper.

Ornamental Drinking Fountains

By W. T. Marlatt, Kenosha, Wis.

One of the fundamental difficulties encountered in providing the public with drinking places rests in the securing of a fountain that is as ornamental as it is sanitary and as sanitary as it is ornamental.

Kenosha has now proven to her satisfaction that such a combination is possible as the fountains now in use not only provide a separate drinking place for dogs but they are so constructed that these animals cannot gain access to the bubblers.

On January 22, 1911, on the most prominent corner in the city was placed a Lansing sanitary fountain, an exact duplicate of the fountain erected in LaFayette Square, Washington.

This fountain faces the main square

and during the warm summer months quenches the thirst of from five to ten thousand people daily. It has been put to a severe test, from the standpoint of wear and tear from almost constant usage. In spite of this fact, the city has not expended a cent for maintenance or up-keep. Altho it is connected with artesian water mains, carrying water highly charged with both iron and sulphur, both tubes and bubblers are apparently in as good condition as when first purchased. On account of these facts the council committee on public grounds is planning to install similar fountains in other portions of the city to take the place of the old-style cumbersome iron fountains, which have become burdensome on account of their cost of up-keep. The fountain is made entirely of bronze and it is more than 12 feet in height. It has four sanitary cups for the use of persons and in addition has a drinking fountain for dogs at the base. For years Kenosha has been without a place for dogs to drink and the new fountain soon found many friends among canines. The whole is perfectly proportioned and at the top is an electric light. The fountain is decidedly ornamental.

The sanitary features of the fountain have been highly praised by the medical experts of the city. This fountain permits every one to drink with equal ease. The bubbler is raised to the height of the lips, while with all other fountains the lips must be brought to the position of the bubbler.

Briefly described, the principal feature of the fountain is in the hose and cup arrangement, which consists of a double tube, the inner tube being the feed pipe for the bubbler, the outer tube acting as a waste pipe for carrying away the surplus water while the person is drinking.

The bowls, pedestal, upper standards and brackets are made of handsomely enameled cast iron. This material avoids any chipping or breaking. This fountain will last as long as marble. The cups are made of aluminum highly polished.

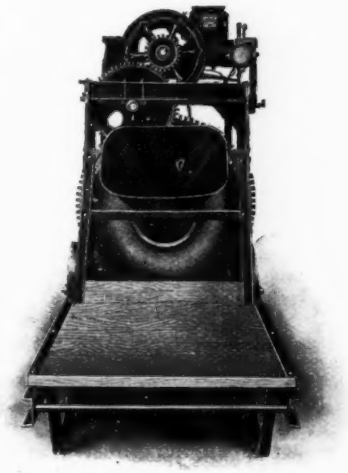
The tubes are made of best quality of pure rubber. The water keeping the rubber cool at all times, prevents their decaying. These tubes that have been in constant use for over a year are apparently as solid as when new, and it is safe to say that they will last from three to four years. They are easily replaced at any time.

This fountain, which is made by the Gier & Dail Mfg. Co., Lansing, Mich., was dedicated October 23, 1911. More than a thousand people attended the ceremonies, at which William Jennings Bryan was the principal speaker.

A Mixer With Overhead Drive

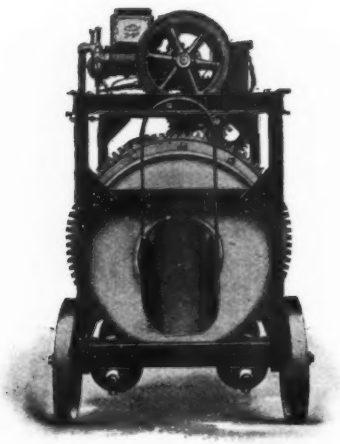
Concrete delivered directly from the mixer to the work is what may be done with the Badger concrete mixer, made by the Badger Concrete Mixer and Machinery Company, Watkins building, Milwaukee, Wis. The Badger is a typical end-discharge machine of the batch, revolving drum type, so arranged as to spout concrete delivery into the forms. The drum has a rated capacity of 6 cubic feet of mixed material per batch, or 9 cubic feet of loose, unmixed material. Its total average, estimated in cubic yards, with a factor of safety for loss of time, moving and ordinary delays, figured at 15 per cent of the efficiency, is 75 cubic yards per day, or 450 surface yards of 6-inch concrete per 10-hour run.

A record run of the Badger mixer was made on a street paving job near Birmingham, Ala., in the town of Bessemer, by the Southern Asphalt and Construction Company, of Birmingham, by the operation of two of these machines working abreast on a 30-foot street. Statistics



BADGER *Concrete Mixer, charging end.*

show that the output of these two machines, with seventeen men and a water boy, in operation, was 180 cubic yards, or 1,080 surface yards of 6-inch concrete on the one day's run. The materials were only wheeled to the 15-inch platform of the mixer and dumped directly into the batch hopper bin; at the same time a batch was being mixed in the drum proper. On account of the extreme lightness and easy portability of the machine, two men, by means of the handlebar arrangement at the rear of the loading platform, were able to constantly pull back the ma-



BADGER *Concrete Mixer, delivering end.*

chine as the work progressed. On this run horse carts and such equipment were entirely eliminated.

Two of the unique features of this mixer are its overhead drive and modern transmission. The power is transmitted to the roller shaft from the main drive shaft by means of bevel gearings held in place by extra heavy bearings which are securely fastened to the main frame and reamed in place to a perfect alignment. At the top of the main driving shaft is a small set of beveled gears to which power is transmitted from the 4-h.p. variable speed engine, by means of silent chain drive, with standard cut steel automobile sprockets. There is a double clutch feature in connection with the power plant above the machine, and the engine can run independent of the mixer, operating trench pumps, conveyors or hoists, and for lighter loads by throwing the clutch on the beveled gears.

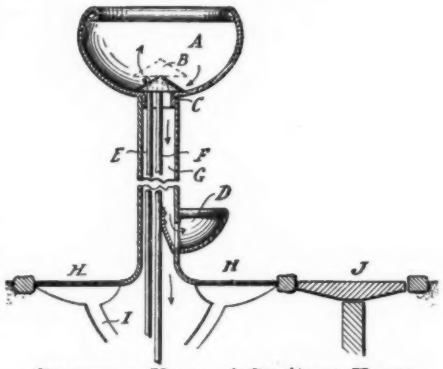
The accompanying illustrations show the 1912 model, but in the 1913 type there is a very noticeable change in the application of power. There are absolutely no gearings, sprockets or chains surrounding drum. The drum is driven entirely by friction by means of V-shaped machined tracks surrounding the drum, bearing directly upon the involute V-shaped rollers. There are seven bearings in the 1913 type, and all these are fitted with something practically new to the mixer world for the elimination of friction. The manufacturers of this machine feel that their expenditure for highest roller bearings will doubly reward them in the elimination of breakdowns occasioned by overheating, etc., at the same time reducing the pull on the engine. The length of the Badger is 9 feet 6 inches, its width over the wheels 3 feet 10 inches, and its extreme height from the ground level to the top of the engine is 7 feet. Its weight complete, ready for shipment, is 2,000 pounds.

Full particulars may be had by addressing Mr. G. L. Sexton, of the Badger Concrete Mixer and Machinery Company, Watkins building, Milwaukee, Wis.

New Sanitary Horse Trough

Following is a brief description of the main features of a new sanitary fountain for horses:

A is a drinking fount of sufficient size to hold a normal drink for a horse, and set high or low, as deemed best for checked or unchecked horses. It is set upon a standard, G, that serves as a waste pipe. Inside of this is the supply pipe E and a stopped rod, F. H H are perforated drains around a fountain to carry off the water that is slopped over, and D is a little dog fount that simply catches the waste from the overflow above. At some point near the fountain, where a horse has to place his feet in order to drink from the fountain, would be a platform device, J, not unlike a scale platform. Normally the stopper C is in position D and the fount is dry. By a simple system of levers, etc., when a horse approaches to drink he is bound to get his front feet on J, which yields sufficiently to operate the mechanism, but not enough to bother a horse. This closes down stopper C and opens the valve in E, and as long as he stands there that valve is open



SECTIONAL VIEW *of Sanitary Horse Trough.*

and the water is running. When he leaves that position the water is closed off, the stopper rises, and the fount is empty of any residue water. Each horse gets a drink of fresh, clean water, and the tank is flushed after every drink. The saving of water over the continuously running tank is also an item in its favor. Plus which, it is an anti-freezing

fountain. The water valve can be, as in most hydrants, well below freezing, and a self-drainer, and there being no water left in the tank, it is a fount that can be kept in operation all winter. It would be a matter simple enough to protect J so that that mechanism would not necessarily fill with water and freeze.

PILE OF GRAVEL *carried thru a twelve-inch pipe by turbine sewer cleaning machine, Nov. 22-23, 1912, under forty pounds water pressure, in Milwaukee, Wis.*

Modern Sewer Cleaning in Milwaukee, Wis.

By Henry J. Kruse, Supt. of Sewers, Milwaukee, Wis.

As sewers are built at the present time you have to use pipe that is made in 2½-ft. lengths and consequently you have a joint every 2½ feet as the depth of the socket is greater than the thickness of the shell of the pipe. Very often, and in fact nearly all the time, you will find an offset made by reason of the cement joint being pushed up into the pipe and leaving the pipe just laid about ½ inch lower than the preceding pipe. The two conditions cause unclean and decomposed putrid matter to lodge along the bottom of the pipe sewers.

Many experiments have been made by noted sanitary engineers of England, France and America. Levy & Miquel, of Paris, Petri, of Berlin, Laws and Andrews, of London, have issued very complete reports on the subject. Mayor Horrocks, of England, made tests which show that there might be considerable danger of infection by sewer air-borne bacteria. The results of these tests were clearly set forth by F. H. Coults, M. D., B. S., D. H. P., F. C. S., before a sessional meeting of the Royal Sanitary Institute at Blackpool, England. Petri plates suspended in a ventilating shaft, such as a manhole, 9 inches above the surface of soapy water containing B. prodigiosus, were infected readily, thus showing that currents of air passing up the vertical shaft would carry the bacteria out into the open air.

Before the validity of the germ theory had impressed itself upon medical men, many diseases were attributed to sewer-gas. Later, when it was understood that typhoid, for instance, was caused only by swallowing the typhoid germ, and it had been found that the foul air of sewers and drains carried many kinds of bacteria, it began to be thought that sewer-gas, after all, might be very disagreeable and injurious.

The foregoing are statements proving conclusively that it pays to keep the sewers of a city in a cleanly condition and emphasizing the needs of machinery which will accomplish this desired result at a minimum cost.

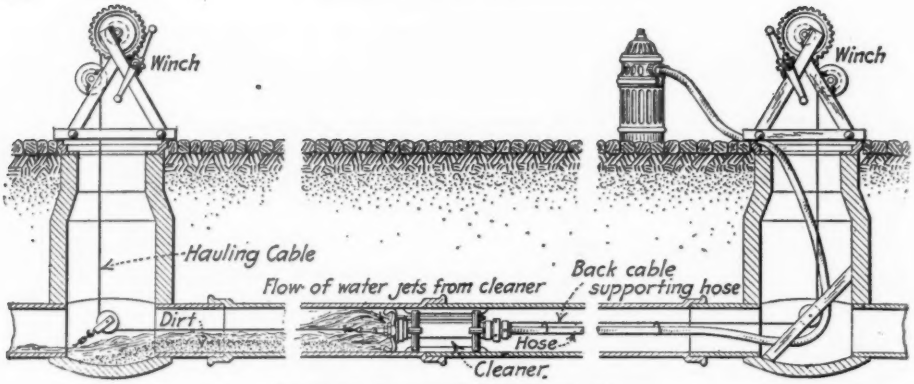
At one of our tests of sewer cleaning machinery, we cleaned 319 feet of badly clogged 12-inch sewer in sixteen hours with four men at a cost of $15, or 5 cents per lineal foot. In case we had not used this machine it would have been necessary to dig up the sewer. With 6 feet of frost in the ground, it would have cost the city from $3.00 to $4.00 per foot for digging up and relaying.

On November 22-23, 1912, the city of Milwaukee used the Turbine machine in cleaning 270 feet of 12-inch pipe with 6 inches of gravel at one end and 9 inches of gravel at the starting point, or an average of 7½ inches of gravel thruout, at the following cost:

Nov. 22—One team hauling machine, 4½ hours, at 50c	$2.25
Nov. 22—Four laborers, six hours each, 24 hours, at 25c	6.00
Nov. 22—33,920 gallons water, meter per M, at 6c	2.04
Nov. 23—One team hauling machine, 2½ hours, at 50c	1.25
Nov. 23—Four laborers, eight hours each, 32 hours, at 25c	8.00
Nov. 23—38,160 gallons water, meter per M, at 6c	2.29
Tot. cost cleaning 270 ft. 12-in. pipe.	$21.83
Cost per foot—$0.0804.	

By way of comparison, will state that old methods of sewer cleaning would have required three men and team fully three days to have cleaned the same amount of sewer under the same conditions as mentioned above. In other words, costs would have been:

One team, 3 days, at $4 per day	$12.00
Three laborers, 3 days, at $2 per day.	18.00
457,920 gallons water, at 6c per M..	27.47
Total cost by old methods	$57.47
Cost per foot—$0.21404.	

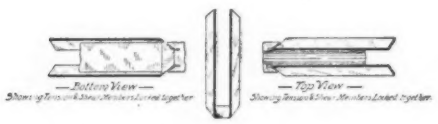


TURBINE *Sewer Cleaning Machine.*

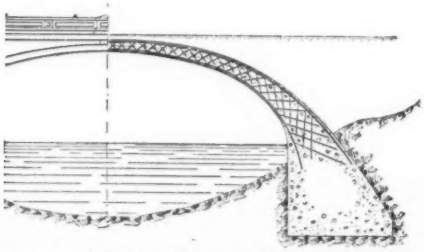
Concrete Bridge Re-Inforcing

In the furtherance of safe, durable and well-balanced concrete bridge construction the Thomas Steel Reinforcing Company, Detroit, Mich., are featuring the "Thomas System," which may be briefly described as follows:

This system provides both theoretically and practically for all stresses, it being claimed that all tension stresses are taken accurately by the steel and compression stresses by the concrete. Shear members may be had in any length or



any section within practical limits and spaced rationally. Shear members or stirrups are kept in stock in standard lengths from 6 inches to 36 inches, crated, tagged and ready to be shipped to the works, where they are fastened to the tension bars by a small apparatus that squeezes the wings made by the punching of the flanges of the bars, or, if it is desired, the reinforcing bars may be sent from the shop with shear members attached, ready to be placed in the forms. Any length of shear members can be used on the same bar, and they may be hooked



SHOWING *lattice effect of shear members.*

at the ends very easily and spaced according to mathematical calculation.

The bars may be used with the shear members placed around the flange or the stem of the bar, as shown in accompanying drawings. This double operation may be used in beams of top and bottom reinforcements and negative moments, over columns in continuous beams. The manner of attaching the shear members produces desirable corrugation on the under side of the bar.

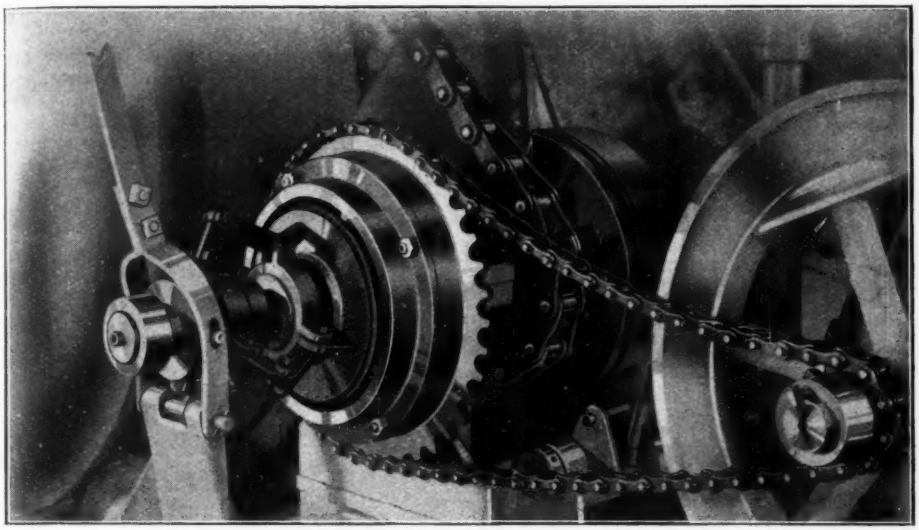
A General Purpose Mixer

By C. R. Meyer, C. R. Meyer & Sons, Contractors, Oshkosh, Wis.

We are not only one of the oldest firms in this section of the country, but were among the first to make use of concrete mixing machinery. As we had always been in the market for any kind of machinery which would lower our operating costs, we saw in the concrete mixer a great labor-saving possibility, and were not slow in testing same on our work. The first mixers were, of course, crude affairs when compared with the machines of to-day, but we were able to save money thru their use, and did all in our power to encourage their manufacture.

We firmly believe that it pays the contractor to spend money for machinery which will enable him to cut his operating expenses and thus place himself in a position to bid successfully on large work yielding him a profit. This is most certainly an age of machinery and it is thru the purchasing and proper use of same that the contractor is enabled to offset constantly increasing material and labor costs. Labor costs are easily 33 1/3 per cent higher than ten years ago, and contractors would find public work almost profitless were they not in a position to cut operating costs by means of efficient machinery.

The concrete mixer has probably done



OSHKOSH MIXER, *single train driving mechanism and special multiple disc friction clutch.*

more to insure more satisfactory work for all concerned than any one machine, as it is used to a certain extent in almost every phase of public construction work. We have followed the growth of the mixer from the very beginning and have owned a machine typifying every stage of its evolution. Our latest purchase has been most satisfactory from the standpoint of accomplishment, as we can mix 290 batches in seven hours on rush work. It comprises several features which mean lower operating costs, as well as minimum maintenance expense. Inasmuch as it is exceedingly adaptable to all phases of contracting work, we are giving herewith a brief description of a few of its constructive features.

This chain drive mixer, which is made by the Oshkosh Manufacturing Company, Oshkosh, Wis., and which is furnished with steam engine, steam boiler, gasoline engine or electric motor, easily has the following capacities:

Number of mixer.....	5	10	20	30	40	60
Capacity per batch in cubic feet of loose material	5	10	20	30	40	60
Capacity per batch in cubic feet of mixed material	3½	7	14	21	28	42
Capacity per hour in cubic yards with standard hopper....	4	8	16	24	32	48
Capacity per hour in cubic yards with power loader.....	8	16	32	48	64	96

The drum is made of steel and gray iron, ¾-inch thick, in two sections, which are bolted together at the flange on a machine joint, the roller tracks being cast in one part with the drum. Segmental sprockets are attached to the flanges in the center of the drum, thus assuring speedy repairs in case of accident, as only the two cap screws or bolts need be screwed up. Material does not clog or solidify in the drum, as it has no pockets or sharp angles. The corners of the drum are at least a 4-inch radius, which makes all material falling against the head flow toward the center. The mixer projections or blades are lifted high enough off the drum shell so that the water or any grouty concrete will flow under them and clean them at every batch.

The mixer projections are so shaped that they turn down and do not pick up the fast-moving concrete, and also so that they pick up the part of the mixture which has the least voids, or, in other words, which is the most solid. This is accomplished by forcing the mixing material into the vortex, which makes a solid mass (relatively solid), so that the lifting projections will lift it up to the discharge chute in one solid mass and not separate it in the discharging.

We were the first contractors to purchase this new machine, and the discharge chute was the one feature which appealed to us, as it gave still another motion to the mixing of the concrete. The chute proper is held and operated by a single yoke, which is keyed directly to an operating shaft at both ends. This makes it possible to discharge from either end or side of the mixer by simply transferring the operating lever.

Choking at the mouth of the hopper is prevented on account of the fact that its

length is such that the material spreads along its length while being hoisted, causing an easy flow of the advancing material in the spout into the drum before it has reached the absolute pouring position, thereby preventing choking at the mouth of the hopper. The batch hopper or power charger and standard charging hopper can be changed one for another in the field with ordinary tools, all parts being standardized and fitted to interchange.

Another feature of interest to contractors is the ease with which all parts can be interchanged on the job with ordinary tools. This machine has a special multiple disc friction clutch of fiber frictions or discs running between metal discs, which allows an easy, smooth-starting, positive-holding clutch, easily operated and easily adjusted.

and coal tar, carefully distilled and proportioned, which has been in successful use in New England roads for over ten years. It is applied by the mixing process and costs from 40 cents to $1 a square yard, the latter figure never having been exceeded. It is made in three grades; No. 1, for dust laying and blanket treatment, and Nos. 2 and 3, for macadam construction by the mixing method. The five-year guarantees given with each completed contract have always been safe propositions for the contractors, as the roads are reported as always outliving them.

Roads treated with the compound do not bleed, crawl or ravel, will stand the heaviest teaming and automobile traffic, are dustless if kept clean, and are maintained for one cent per yard per year. Ma-Drite is not patented and is therefore subject to no royalties.

MA-DRITE *Pavement, view of completed street.*

Laying MA-DRITE *Pavement.*

Ma-Drite Bituminous Paving Compound

The problem in modern road construction is a compound for filling the voids and cementing together the stones in macadam wearing surfaces. Ma-Drite is a bituminous combination, made of asphalt

Water-proofing Sewers

By W. W. Dixon.

Modern sanitary demands, including those of sewage disposal plants, make water-tight sewers imperative. G-K compound has been brought forth to meet these demands and has done so.

Tarvia

Preserves Roads
Prevents Dust

Broadway, Norwich, Conn., Treated with "Tarvia B."

A Dustless Thoroughfare

"TARVIA B" is a tar product which is liquid at normal temperatures and can be applied to the surface of a macadam road from a modified sprinkling cart, no other apparatus being necessary.

The usual procedure is to sweep the road of surface dust and dirt, apply the Tarvia B and keep the traffic away for a few hours until the Tarvia has penetrated into the road surface. This grade of Tarvia is used only on roads where the rolling effect of traffic has made the interstices between the stone very small; on this account a denser grade of bitumen would not do, because it could not percolate into so closely bonded a surface. Tarvia B, however, finds its way into such surfaces and forms a matrix, holding the fine screenings in position, preventing raveling and erosion, preventing the formation of dust by automobile traffic and greatly prolonging the life of the roadway.

A typical instance of the use of Tarvia B is in Norwich, Conn., Mr. E. C. Lillibridge, the Street Commissioner there, wrote as follows:

November 15, 1912

"You ask for my opinion concerning Tarvia B to which I will say I do not believe it has any equal. We have used this material for three years and the more it is used, the better satisfaction it gives, as to preserving the road and lasting longer. We have the last year used this material on two miles of streets and today those streets are in excellent condition after the traffic of heavy teams and autos"

In addition to Tarvia B there is Tarvia A for hot surface application and Tarvia X for road construction.

Booklets sent free on request.

BARRETT MANUFACTURING COMPANY

TRADE B MARK

New York Chicago Philadelphia Boston St. Louis Kansas City Cleveland
Cincinnati Minneapolis Pittsburgh Seattle Corey, Ala.
The Paterson Mfg. Co., Ltd.—Montreal, Toronto, Winnipeg, Vancouver St John, N. B., Halifax, N. S.

The plastic nature of the compound originally sold as "dip," and since known as G-K by copyright, was first noted in 1909 by John S. Stiger, late city engineer of Summit, N. J., and he directed that a joint be made with the material. Record of the test was published in October, 1910, and the material was specified and used in several sewers built in 1910 and 1911 by the city of Summit. Other engineers investigated and found this use economical, although the composition was more expensive than cement and sand.

G-K sewer joint compound is the result of several years of chemical experimentation and is a chemical compound, not a mere mechanical mixture. It is a combination of vulcanized linseed oil and anhydrous clay, the vulcanization being covered by many letters patent.

The claims of the manufacturers are for a sanitary, water-tight sewer, and flexible joints, which make the sewer sanitary and reduce to a minimum danger of breakage of pipes due to heavy backfill or soft subgrade or other cause for movement of the completed sewer line. The use of G-K compound in wet trench work is a great saving, as in hardening it shows no appreciable shrinkage, checks or cracks and so it is absolutely impossible for roots to penetrate. The following letter, written at an editor's request by Julius Keller Construction Co., Indianapolis, and not to me, shows a source of saving to the contractor:

"The sewer was to be laid in a water-bearing gravel and sand soil, specifications calling for a water-tight sewer on completion, and the jointing medium to be (a sewer joint compound on the market). Encountered water very close to surface, necessitating close sheathing. We found it practically impossible with steam pumps, working day and night, to reduce the water level so that we could use (that compound) and make a joint that was at all satisfactory to ourselves and engineer. We then used G-K and made perfect joints in the presence of quantities of water, and discarded the pumps."

Regarding flexibility, the following quotation from the same letter is conclusive:

"A very interesting and curious condition was met with on one occasion, to-wit: A section of sewer 12 inches in diameter, 64 feet in all, was laid and joined with G-K compound, and before any backfill had been commenced we had a heavy rain for several hours, filling trench to surface. When water was removed it was found that gravel and soil had washed under the pipe and had caused the line to bow upward until it was washed out of grade 14 inches in center. In spite of this, the section of sewer was tight. This flexibility we consider a truly wonderful example of the G-K compound from an engineering standpoint."

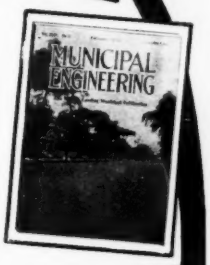
In practice the compound is heated in a heavy shallow iron pot rather than one of the lead pot variety and is heated to a temperature of 350 to 400 degrees. At this temperature the material is as fluid as water. The joint is first packed with oakum, after which an asbestos runner is placed around the bell and the joint is poured a little off center. The compound filling the annular space runs completely around the pipe, reappearing at the top of the other side. This process was successful in 48-inch reinforced concrete pipe, poured 3 inches off center.

The compound makes an absolute bond with tile of the highest glaze. Bond, flexibility, freedom from cracks or checks, and complete filling of annular space give joints absolutely water-tight with any possible deflection, expansion or contraction in a sewer pipe line.

Infiltration of water at dead ends and branch connections is prevented by a specification that "the vitrified stopper shall be set in openings of branches and a sufficient quantity of G-K compound poured in the inner circumference of the bell to tightly seal it." When necessary to complete the house connection, a small piece of waste or paper burned under the end of the pipe will soften the compound so that the stopper can be removed without danger of breaking.

It is not unusual to find sewers laid with ordinary joints showing infiltration of 25,000 to 50,000 gallons per sewer mile per day and amounts of 250,000 and 500,000 are well authenticated. Leakage of sewage into dry soils is just as likely and will pollute water supplies drawn from water levels below. It costs money to pump infiltration water and to treat it in sewage disposal plants, so that in either case economy demands water-tight joints.

L. W. Freeman, assistant engineer of Borough of Richmond, New York City, reports test of section of 15-inch vitrified pipe sewer with G-K compound in joints of only 450 gallons per sewer mile per day after immersion six days under 5-foot head. E. C. Catley, resident engineer for Alexander Potter, reports results of tests on South Orange, N. J., on short sewer lines with G-K compound in joints under internal and again external hydrostatic pressure of 5 feet finding them absolutely tight. The completed Hilton section showed about 400 gallons infiltration per sewer mile per day. Mr. Catley terms this very small for a sewer system of 3.53 miles of pipe, half below ground level and some under ground water head of 3 feet.



MUNICIPAL ENGINEERING

(Established 1890)

"The World's Leading Municipal Publication"

Bring your factory products to the direct attention of Mayors, City and County Engineers, Heads of City Departments and Public Contractors in all sections of the country.

Municipal Engineering is the recognized authority on all public matters. It is the oldest publication in its field, has the highest circulation and the largest advertising clientage. For nearly twenty-four years it has successfully supplied the subscriber with the livest and most practical information.

No matter what policy you may pursue in selling your product, you need **Municipal Engineering.**

The influence of **Municipal Engineering** with the public's buyers is the greatest aid your sales department can possibly have.

The Municipal field spends more than twelve hundred millions of dollars annually in physical improvement work.

Let our Special Service Bureau submit you a report showing the tremendous possibilities in a properly conducted campaign for business in this field. No expense attached to this report.

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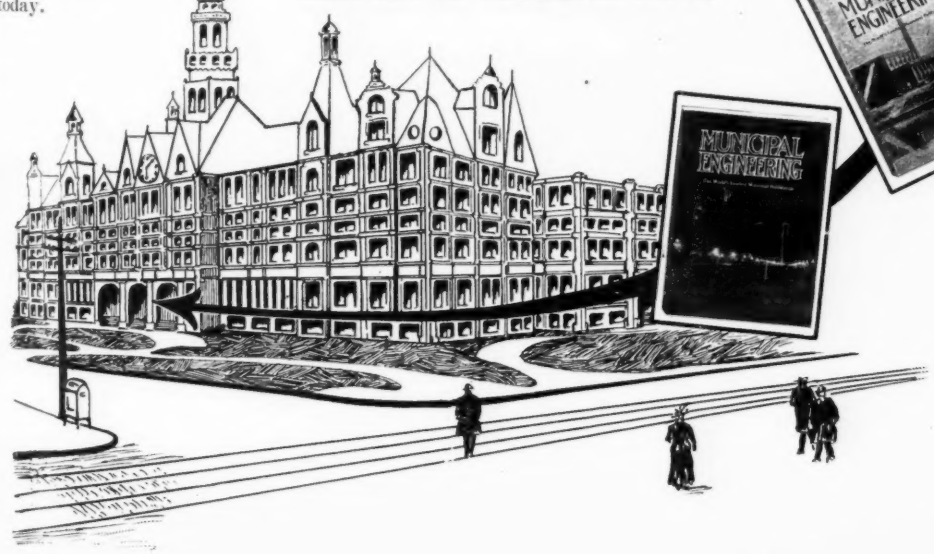


Increase of sewer sizes 20 to 33 per cent. to take care of infiltration is evidently unnecessary if G-K compound is used and that expense is saved.

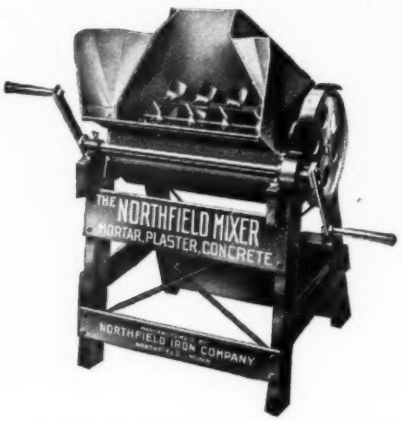
The Northfield Mixer

The Northfield mixer is a very lightweight and substantially built and convenient machine which is coming into popular use on both large and small work in the municipal contracting field.

August Sahlberg, clerk of Stockholm township, Cokato, Minn., states: "With the Northfield two men can easily do all the mixing as fast as a third man can wheel the gravel. I always place the mixer so as to dump the concrete directly in the forms. The machine is light enough to be easily moved by two men. The speed or capacity is generally regulated by the men wheeling in the gravel. On ordinary bridge work, where the gravel has to be moved from 25 to 50 feet, and the water and the cement cannot be placed near enough to be real handy, I find that three men do the most uniform work and will average about 3 cubic yards per hour. If everything is real handy, a batch per minute can be mixed, but a wall will grow so fast at this rate that the machine will soon be too far away from the gravel and water, etc., to continue at any such speeed. Three men around the mixer will keep me busy building forms. I have averaged 30 cubic feet per day on big jobs without any rush, and persons familiar with hand-mixing can figure out what a saving that means. I built two concrete arches of exactly the same size and with the same crew, one before getting the mixer and one after, and found that there was a saving of 2½ days' time by the crew of four men. The digging and other preparing required exactly the same time in both places. It is so compact and requires such small space that it can always be placed so as to dump the batch directly into forms, without second handling or transportation.

"When operated by hand power the discharge is completely automatic, for all that is required is to reverse the motion on the cranks and the drum is instantaneously dumped, requiring less than a second to accomplish this feat, and then by reversing the motion on the cranks again is instantly swept out clean, and the righting of the drum to charging position is then also semi-automatic. But slight assistance by the hand is required to turn it over into place, as the motion of the mixing shaft has a tendency to lift it back again, and at times it will accomplish this feat automatically, without the operator assisting with his hand at all. The drum has a convenient locking device for holding it securely in the charging position, which can be used or not, just as the operator finds it most convenient. The drum can never dump of its own accord when the mixing is going on, and this locking device is seldom used except to back up or leave the drum full of mixture for a time.

"It has been found from careful observation on regular work that an ordinary crew of workmen turn the crank on this mixer a trifle faster than one turn per second. Not over thirty turns are required to thoroly mix mortar or concrete after the drum is charged. And it requires not to exceed three to five seconds to dump the batch, and about the same time to right the drum again for receiving the next batch. Charging never requires over fifteen or twenty seconds, so that with two steady workmen at the cranks, who attend to pouring in the water and cement and discharging the batch, and with enough wheelers to keep the mixer recharged without delays, there is absolutely no trouble to average a batch per minute with this machine, when mixing wet or slush concrete."



The Hand Power Northfield Mixer.

This mixer is manufactured by the Northfield Iron Company, Northfield, Minn., and Mr. C. L. Brown, of this concern, states:

"We guarantee the Northfield, on slush concrete work, under favorable conditions, to be full rated capacity, as shown by the table below. This capacity is conservatively based on careful observations taken from results obtained with machines that were in actual use on various construction jobs, and with ordinary workmen, instructions for operating being carefully followed. The minimum yardage is based on batches charged with 3-foot barrows, and the maximum yardage is based on batches charged with 4-foot barrows, and assuming that conditions are so favorable

Coldwell Lawn Mowers

Coldwell Motor Lawn Mowers on the Tennis Courts, Prospect Park, Brooklyn, N. Y.

MORE than 600 Coldwell Motor Lawn Mowers are in use today at Golf and Tennis Clubs, on U. S. Government reservations, and in public and private parks.

A Coldwell Motor Mower is the best and most economical mower made for use on large lawns. Saves the expense of three horses and two men. Simple in construction, powerful, and strongly built.

The Coldwell Company makes the most serviceable and complete line of lawn mowers on the market—hand mowers of all kinds, as well as horse and motor mowers.

Whatever style of lawn mower you require, there is a "Coldwell" that just fits the need.

If you are interested in the care of lawns, write for our illustrated booklet, mailed with catalogue on request.

COLDWELL LAWN MOWER CO.

Philadelphia NEWBURGH, N. Y. Chicago

that each wheeler can load and wheel up and dump his barrow into the mixer drum every two minutes, and that these laborers be paid 25 cents per hour for a ten-hour day, batches to be discharged directly into forms:

Size of Crew.	Safe Average Time per Batch.	Average Cubic Yards.	Average Cost Per Cubic Yard
2 men	3 min.	20 to 27 yds.	25 to 18½ cents
3 men	2¼ min.	30 to 40 yds.	25 to 18½ cents
4 men	1½ min.	45 to 60 yds.	22 to 17 cents
5 men	1 min.	67 to 90 yds.	19 to 14 cents

"If the mixer is operated with gasoline engine or motor instead of by hand, a saving of practically one man's time can be made on the above schedule. We furnish the mixer all rigged with extra shafting, gear and belt pulley for running by power at a slight additional charge. In operating with five men, as shown above, the fifth man helps shovel and unties the sacks of cement, attends to water barrel, etc. If conditions are not favorable you may not be able to mix more than one-half the above rated capacity, but, even so, the Northfield will mix faster than the majority."

Ornamental Lighting in Topeka, Kan.

By A. R. Young, City Engineer.

We have 157 ornamental lighting poles in service in fifteen blocks, having installed 108 in the year 1911 and 49 in the year 1912.

This method of lighting has proven very satisfactory and it is our intention to make further additions to the system in the very near future.

Each pole is equipped with 10-k.-w., 2,200-110-volt single phase transformers connected for two-wire 110-volt distribution. Transformer poles are equipped with moisture-proof metal cabinets accommodating four 61-100-ampere and two 1-30-ampere cut-outs, also one double-pole solenoid-operated switch for a.c., 110-volts, 60-cycle, 100-ampere. The blades of this switch are connected so as to operate as a separate or independent single-pole switch, and one of the 61-100-ampere cut-outs is installed between the transformer and the switch. All cut-outs are of the 250-volt enclosed type, each 61-100-ampere cut-out fused at 75 amperes, and the 1-30 fused at 20 amperes. The style of wiring from the pole cabinet is such that the solenoid switch controls the four-arm lights of all poles and the top light is independent.

All wires and cables are installed in conduits, which are lead covered and insulated with varnished cambric. All wires in lamp columns are No. 12 rubber covered. No. 6 cables are looped into the Edison cut-out in base of poles. At all connections in lamp posts the lead cable is looped to such a height that all taps are 6 inches above sidewalk level. All cable splices are protected by a lead sleeve large enough to allow for a sufficient amount of varnished cambric tape to properly insulate the joint. Conduits are bituminized fibre as manufactured by the American Conduit Co., and are incased in concrete with a covering of 3 inches on all sides.

The posts are wired so that the solenoid switch will turn off the arm lights and leave the top light burning. All posts are fitted with Edison plug cut-out No. 8042 in the base of pole and fused at 6 amperes. Access to this cut-out is thru a door in base of pole, which is fitted with a lock and key. All posts are fitted with lamp sockets manufactured by Pass and Seymour, No. 423 globe holders, globes and 108-volt 100-watt regular Mazda lamps. Globes are thin and white. Arm globes are 12 and top globes are 16 inches. All poles are bolted to a concrete base.

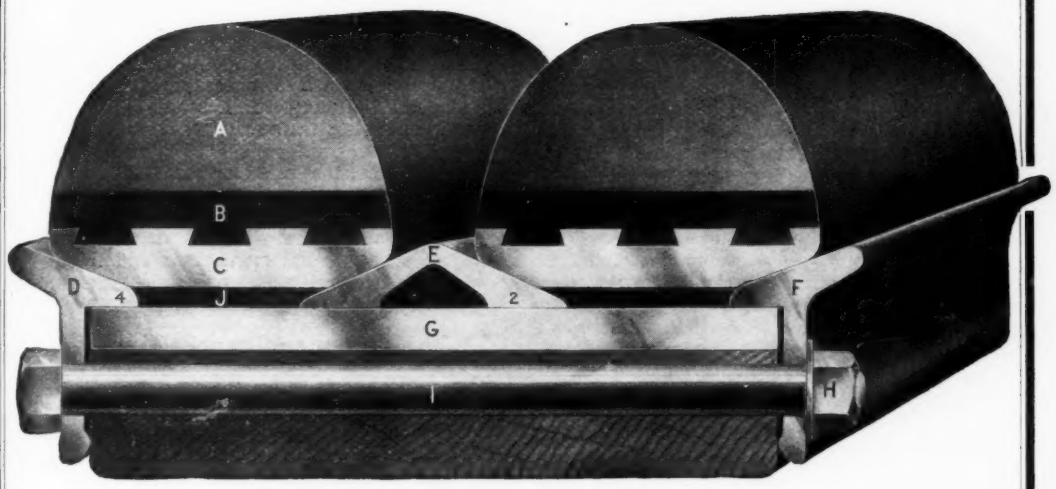
Our ornamental lighting system is not only a source of great pride to our citicens, but also receives the highest commendation from outside engineers. Our ornamental "De Lux" standards are made by the King Foundry Co., St. Joseph, Mo., of special blended iron and steel. The city of Topeka assumes maintenance and current expense. The total expense per block is about $200.00. Initial cost per running foot ranges from $1.60 to $2.25. The average annual cost for renewals on account of globe breakage is $1.08.

Kentwood, La., Pumping Plant

By George F. Conant, Engineer in Charge.

The pumping machinery installed in the Kentwood plant is a combination city water works system for domestic and fire service. The pumps meet all the requirements of the fire underwriters. The small engine and air compressor supply compressed air for instantly starting either or both of the pumping units. This is an exceptional installation inasmuch as fire pumps are not usually operated by oil en-

Tires of Guaranteed Efficiency for Municipal Service



United States Standard Demountable Tires have the well-earned distinction of being the most efficient motor truck tires on the market today.

This is an important statement to every municipal department man who has a haulage problem on his hands.

Efficiency is the watchword of the modern business and mechanical world today. The departments which are making the best showings are the departments that have come the closest to making every man, machine and appliance throughout the organization 100 per cent efficient.

Clearly this rule applies to the delivery and haulage departments as well as to any other branch of work.

If you are compelled periodically to lay up your trucks and tie up your deliveries hours or days at a time while a wheel is away at some distant repair station for a tire replacement, you have a weak, inefficient spot in your delivery system that would not be tolerated a day if it occurred in a modern manufacturing plant.

UNITED STATES STANDARD MOTOR TRUCK TIRES

(DEMOUNTABLE)

have forever done away with inefficiency of this sort.

Here is a tire that can be replaced in the garage by the driver himself after working hours. And it will take him only fifteen minutes to do the job (even for dual equipment).

Expensive, troublesome, repair shop delays are a thing of the past. Carry a spare tire on your truck and you are independent.

Furthermore, United States Tires bear an unprecedented

GUARANTEE for 10,000 miles of service

(conditional upon its being used in one year's time.)

That will enable you to put your trucks on a lower cost per mile of service than you have ever been able to do before.

From the standpoint of both **time** saving and **money** saving, United States Standard Tires are well nigh 100 per cent efficient.

UNITED STATES TIRE COMPANY

NEW YORK.

gines, and special specifications were drawn up and submitted to the Louisiana State Board to cover the situation.

Our machinery consists of one 60-h. p. Fairbanks-Morse oil engine, direct connected by Eclipse friction clutch to 7x12 Fairbanks-Morse duplex plunger and ring pattern power pump, and one 80-h. p. Fairbanks-Morse oil engine, direct connected by Eclipse friction clutch to 9x12 Fairbanks-Morse duplex plunger and ring pattern pump. It is my opinion that for plants of our size, the cost of operating an oil engine is considerably less than steam on account of decreased cost of fuel. Then when fuel is only required when plant is in actual operation, there is absolutely no waste. Such a plant is always ready for instantaneous service and there is no delay on account of low steam pressure, for firing up boilers. The cost of operating such an engine is in direct proportion to the amount of work done and there are no costs piling up when the plant is not running.

Our well is 727 feet in depth and has a natural flow of over 500 gallons per minute. Our concrete reservoir has a capacity of 125,000 gallons filled by flow from well, the surplus overflowing thru a pipe at the top and just beneath the roof.

Our 60 h. p. engine is directly connected with a 500-gallon-per-minute pump and our 80-h. p. engine is directly connected with a 750-gallon-per-minute pump. The former engine uses nearly 6 gallons of oil per hour and the latter about 8 gallons, pumping direct from the concrete reservoir into an elevated steel tank against a head of 185 feet which gives sufficient pressure for fire purposes.

Our plant is operating very successfully and we believe at a minimum expense.

Uniform Pressure Flusher

The Etnyre uniform pressure flusher is equipped with a two-cycle, air-cooled motor, directly connected with a powerful centrifugal pump and mounted on the same base. It is suspended from the steel frame at the rear of the wagon, and, in operation, produces a uniform pressure on the flushing nozzles from the first to the last gallon of water in the tank. The pressure can be reduced to any desired amount instantly at the will of the operator by the use of the controlling foot levers.

The engine is provided with an automatic governor, so that it cannot race when running idle, and a switch connection with the driver's seat permits of its being stopped instantly. The motor is of the most simple and durable construction and can be operated by any ordinary workman, and is started by turning flywheel one-quarter turn in either direction. The flushing nozzles are set low and can be turned at any desired angle to obtain the best results. The tank is made of heavy steel, and is provided with manhole and hose connections, as well as separate opening for filling from standpipe. The tanks on this flusher can be filled more quickly than in other types, as the water does not have to run against pressure.

The standard tank has a capacity of 600 gallons, and is made of 12-gauge galvanized steel. These machines may also be equipped with a pressure sprinkling device as well as with hose and connections for filling tank with the motor and pump at the rate of 250 to 300 gallons per minute, at a raise of from 20 to 25 feet.

E. D. Etnyre & Co., Oregon, Ill., make these machines, as well as a complete line of motor truck sprinklers and flushers of both gravity and pressure types.

The Monahan Trench Digger

The view, shown herewith, illustrates the manner in which, in cutting the bottom of a trench, the buckets on the Monahan trench digger actually do the work, instead of the back pans, as is the case on many other machines.

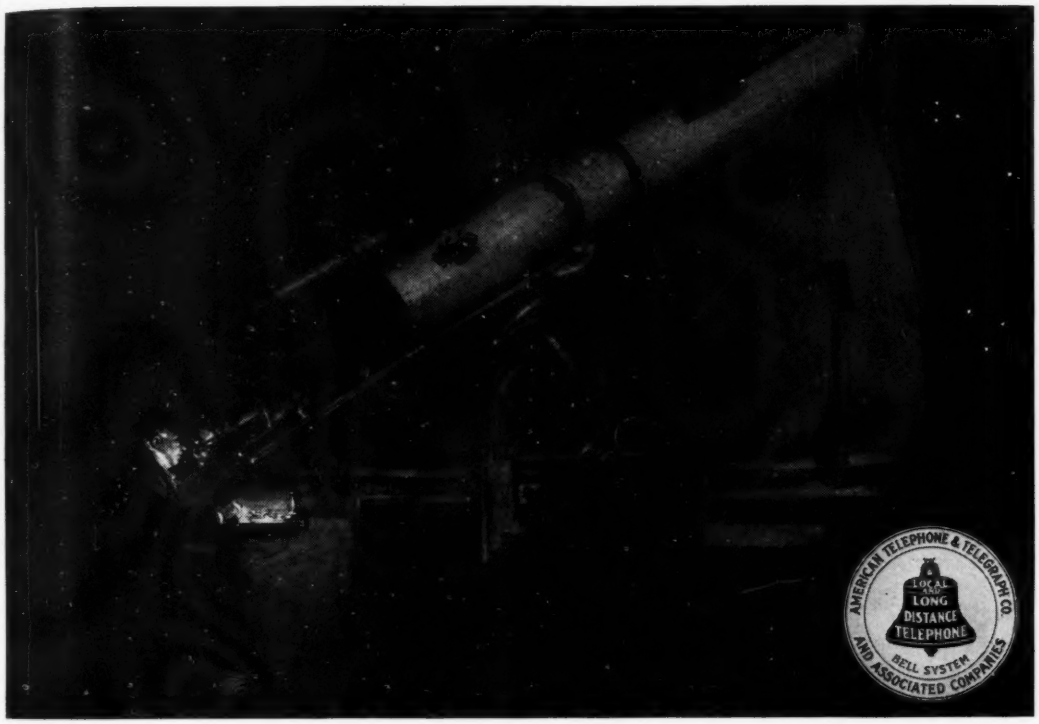
These buckets are 28 inches apart and are built in sizes from 24 to 48 inches wide, by 10 inches deep. They are held on the chain by two arms attached to the link ahead, so as to give bucket an opening of 72 degrees at the dumping end. Each bucket is fastened to the arms by two ⅝-inch cotter pins, which shear off when a sudden obstruction is encountered, thus avoiding damage to the machine. The digging teeth are set in cast pockets and consist of one piece of 1½x1-inch tool steel, and are held in place by cotter pins, which simply prevent the tooth from falling out, but do not sustain any part of resistance in digging.

These machines were designed by a mechanical engineer, who received his knowledge of trench digging and sewer contractors' requirements by actually being engaged in that business.

The Monahan trench digger is equipped with a 45-h.p. self-propelling engine. Three jaw clutches control the entire operation of the machine, including traction.

On traction there is a direct drive to the back traction wheel, which is 54 inches in diameter and 48 inches in width. An open steel gear of 4-inch pitch eliminates the necessity of a differential, which usually weighs from 1,000 to 1,500 pounds, is difficult to properly lubricate and subject to constant wear.

But two men are required to operate these machines, which are made by Wm. Heggie, of Joliet, Ill.



The Telescope of Speech

The astronomer, by the power of his telescope, becomes a reporter of the movements of a hundred worlds greater than ours, and the student of celestial activities millions of miles away.

He points his instrument at any spot in the heavens, and his sight goes rushing through space to discover and inspect a star hitherto unknown.

Up to the power of his lenses, his vision sweeps the universe.

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Your voice may be directed anywhere in the Bell System, and it will be carried across country at lightning speed, to be recognized and answered.

The telescope is for a very limited class, the astronomers. The telephone is for everyone.

At the telescope you may see, but cannot be seen. At the telephone you may speak and be spoken to, you may hear and be heard. By means of the Bell System this responsive service is extended to the whole nation.

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Trade Publications

The Sandusky Portland Cement Co has issued a handsome booklet devoted to Medusa waterproofing for making concrete water-tight. It is well worth asking for as it is full of valuable information.

The Texas Company discontinues its house organ, entitled "Paving and Roads," and will issue occasional bulletins on the subject.

The fourth annual Public Service Corporation Review will be published by *The Financial World*, 18 Broadway, New York City, on April 26.

The Fred Medart Mfg. Co., Dekalb and President streets, St. Louis, Mo., issues "The Story of My Ideal Playground," written by a playground committeeman.

A booklet has been issued by the Cameron Septic Tank Co., Chicago, Ill., explaining its position in septic process patent legislation, particularly with reference to the Knoxville, Iowa, case.

The National Tube Company's "Book of Standards" is a 600-page handbook of detailed and accurate information on air, gas, water and steam transmission in pipes. It is well worth the $2 asked by the company, 1106 Frick building, Pittsburg, Pa.

The National Fire Proofing Co. has issued a catalog showing the Natco imperishable silo.

The Universal Portland Cement Co. issues a valuable booklet on "Concreting in Cold Weather," with special reference to the needs of the farmer and small town contractor, which will be sent on request sent to 72 West Adams street, Chicago.

The Current o' Scope shows in a simple and correct manner how the so-called revolving field is produced by the action of alternating currents in a 3-phase alternating current induction motor. It is mounted on a card and the turning disc shows the changing conditions. For 25 cents it will be sent by Fairbanks, Morse & Co., Chicago, Ill.

Catalog 805 of Studebaker, South Bend, Ind., is devoted to Studebaker dump wagons, and shows details of all parts and the advantages they have.

Bulletin 46 of the Jeffrey Mfg. Co., Columbus, O., describes the Jeffrey swing hammer pulverizer for laboratory use in reducing many kinds of materials.

The Sherman equal heat gas burner is shown in a booklet of the Sherman Mfg. Co., Detroit, Mich.

The Buffalo Pitts Co., Buffalo, N. Y., issues a fully illustrated catalog of its special hauling machinery for road building purposes and the like.

The National Police Signal Co., Buffalo, N. Y., issues a booklet descriptive of its police signal systems.

Trade Notes

Manning, Maxwell & Moore, 85-87-89 Liberty street, New York City, have taken the agency for the Chain Belt concrete mixer, concrete elevator, spouts and other concrete machinery manufactured by the Chain Belt Company, Milwaukee, Wis.

A contract for standard Raymond concrete piles, to support the reinforced concrete arch over Gallagher's Gulch, Tacoma, Wash., has been awarded to the Raymond Concrete Pile Company, thru their northwestern office at Portland, Ore. W. C. Raleigh is city engineer of Tacoma.

Elastite paving joint, manufactured by the Philip Carey Company, Lockland, Cincinnati, O., has been installed for experimental purposes on Garden street, between Green and Walnut streets, Louisville, Ky. It has been in use in street pavements in Bloomington and Richmond, Ind., for some time, and its use is rapidly extending.

The Chatfield & Woods Company, Cincinnati, O., wants a second hand road roller, gasoline motor preferred.

The H. W. Johns-Manville Company announce the removal of their Newark office to 239 Halsey street. Their new office and salesroom is located on the ground floor for J-M asbestos roofings, packings and pipe coverings, brake lining and auto accessories, "Noark" fuses and protective devices, Frink lighting fixtures, etc. The company have opened a branch office in the Dooly block, Salt Lake City, to take care of their rapidly increasing business.

The Ceresit Waterproofing Co., Chicago, have established a department of superintendence and put it in charge of John J. Lyons, who will provide for the superintendence of the use of their waterproofing when engineers or architects desire a check on contractors for such work, in which case the company can give a bond of guarantee.

The American Water Works & Guarantee Company, of Pittsburg, Pa., has awarded contract to the Epping-Carpenter Company, of Pittsburg, for the construction of a seven-million-gallon vertical triple expansion condensing pumping engine, to be installed at their plant at Chattanooga, Tenn.

The office and factory of the Union Clay Products Co., makers of G-K sewer joint compound, are now at 14-20 Water street, New Brunswick, N. J., with greater facilities for quick dispatch of orders.

John Baker, Jr., 332 South Michigan avenue, Chicago, has added to Texaco asphalt, which he has heretofore handled, the well-known Star brand of California asphalt made by the Standard Oil Co. Fluxes and road oils are included in both lines.